TANDBERG DATA

SCSI Command Set

RDX® QuikStation® 4

Part Number 1021862 Rev. A July 2015

www.tandbergdata.com

PART NUMBER 1021862 A

REVISION HISTORY

Revision	Date	Description
A	July 2015	Initial release.

Note: The most current information about this product is available at Tandberg Data's web site (www.tandbergdata.com).

PRODUCT WARRANTY CAUTION The RDX QuikStationby Tandberg Data Corporation is warranted to be free from defects in materials, parts, and workmanship and will conform to the current product specification upon delivery. For the specific details of your warranty, refer to your sales contract or contact the company from which the library was purchased.

The warranty for the appliance shall not apply to failures caused by:

- Physical abuse or use not consistent with the operating instructions or product specifications.
- Repair or modification by any one other than Tandberg Data's personnel or agent in a manner differing from the maintenance instructions provided by Tandberg Data.
- Removal of the Tandberg Data identification label(s).
- Physical abuse due to improper packaging of returned unit.

If problems with the RDX QuikStationoccur, contact your maintenance organization; do not void the product warranty by allowing untrained or unauthorized personnel to attempt repairs.

Caution Returning the RDX QuikStationin unauthorized packaging may damage the unit and void the warranty. If you are returning the unit for repair, package it in its original packaging (or in replacement packaging obtained from your vendor.)

CONTACTING TANDBERG DATA CORPORATION Visit the Support section of the Tandberg Data web site (http://www.tandbergdata.com) for information on contacting Technical Support.

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ABOUT THIS MANUAL

This manual provides reference information for developing SCSI applications for the RDX QuikStation.

The table below lists the logical device types that the RDX QuikStation can emulate:

Disk Configurations	Eight Tandberg Data RDX targets. One logical volume

Intended Audience

This manual is intended for use by application developers. It assumes users understand SCSI command format and protocol. For more information about SCSI, refer to "Standards Information" on page xi.

Contents of This Manual

This manual contains supported SCSI command information for the following RDX QuikStation logical device types:

- Tandberg Data RDX removable disk drives (see Chapter 2)
- Tandberg Data T24 StorageLibrary and Tandberg Data StorageLoader (see Chapter 4)

Related Publications

For additional information about the RDX QuikStation, refer to the following publications, which are available at www.tandbergdata.com.

- *RDX QuikStation Quick Start Guide, part number 1021807*
- *RDX QuikStation Product Manual, part number 1021829*
- *RDX QuikStation Knowledge Base articles*

Standards Information

The following standards information is available at http://www.t10.org/drafts.

RDX Removable Drives

- *SCSI Primary Commands-2 (SPC2)*
- *SCSI Primary Commands-3 (SPC3)*
- *SCSI Primary Commands-4 (SPC4)*
- MultiMedia Command Set - 4 (MMC-4)

Tandberg Data StorageLibrary T24/StorageLoader

- *Small Computer System Interface - 2 (SCSI-2)*, INCITS 131-1994[R2004]
- *SCSI Primary Commands-2 (SPC-2)*, INCITS 351-2001
- *SCSI-3 Primary Commands (SPC)*, INCITS 301-1997 [R2002]
- *SCSI-3 Medium Changer Commands (SMC)*, INCITS 314-1998 [R2003]
- *SCSI Parallel Interface-4 (SPI-4*), INCITS 362-2002
- *TapeAlert Specification*, NCITS T10/02-142R0, Version 3.0, March 2002
- IEC 60297 Rack Standards
- *Automation/Drive Interface - Commands (ADC)*, Working Draft, Revision 7, September 14, 2004
- *Automation/Drive Interface - Transport Protocol (ADT)*, Working Draft, Revision 14, November 18, 2004
- *SCSI Media Changer Commands - 2 (SMC-2)*, Working Draft, Revision 7, November 18, 2003

Conventions Used in This Manual

This manual uses the following conventions:

Note: Notes provide additional information or suggestions about the topic or procedure being discussed.

! Important Read text marked by the “Important” icon for information that will help you complete a procedure or avoid extra steps.

⚠ Caution Read text marked by the “CAUTION” icon for information you must know to avoid damaging the RDX QuikStation or losing data.

1

SCSI Interface Overview

This chapter provides an overview of how the Small Computer System Interface (SCSI) is implemented in the RDX QuikStation. It discusses the following topics:

- Communication interface versus command protocol
- Communication across the SCSI bus
- SCSI commands supported by the tape drive
- Format of the SCSI command descriptor blocks
- Command status supported by the tape drive

Communication Interface Versus Command Protocol

When two devices are connected across a bus or a network, their interaction is accomplished through a communication interface (for example, a parallel SCSI bus, a Fiber Channel arbitrated loop, or an Ethernet network). The communication interface allows multiple devices to share connections, yet operate and exchange data independently. The communication interface is comprised of the physical interface and the signaling protocol used during communication.

The physical interface determines the number of devices that can be attached to a bus or network loop, the maximum length of the cables, and the physical characteristics of the cable itself (for example, the number of wires, shielding, and so forth). The signaling protocol defines the electrical characteristics and timing of signals carried by the cable, the message system requirements, transmission speeds and maximum data transfer rates, as well as the encoding and decoding of the individual bit patterns representing commands passing between the individual devices.

The format and content of the information carried over the communication interface, as well as how each device uses and responds to the information, is governed by a *command protocol*. The command protocol determines how the host (or initiator) interacts with the target device (for example, the tape drive) by issuing commands, transferring data, and responding to status information. The command protocol also defines the individual bits in the command data passing between the individual devices. The target device responds to commands from the host by performing the requested operation (for example, writing or reading data on magnetic tape) and returning status information to the host.

Communication Across the SCSI Bus

This section explains how communication across the SCSI bus is implemented. It discusses the SCSI bus phases and messages supported by the tape drive.

SCSI Bus Phases

Bus phases determine the direction and type of information transferred across the data lines of the SCSI bus. The possible bus phases include Bus Free, Arbitration, Selection, Reselection, and Transfer (which includes four subsets: Message In or Message Out, Command Out, Data In or Data Out, and Status In). Table 1-1 describes the bus phases.

Table 1-1 *SCSI bus phases and information transfer phases*

Bus Phase	Description
Bus Free	The Bus Free phase specifies that no device is using the bus.
Arbitration	The Arbitration phase allows devices to compete for access on the bus.
Selection	The Selection phase allows an initiator to select the tape drive for communication.
Reselection	The Reselection phase allows the drive to reconnect to the initiator after it disconnects.
Transfer	The Messages phases help manage the physical path between the initiators and targets.
Message In	The drive sends a message to the initiator.
Message Out	The initiator sends a message to the drive.
Command Out	The initiator sends a command to the tape drive. Commands contain information about what actions the tape drive should perform.
Data In	The tape drive transfers data to the initiator.
Data Out	The initiator transfers data to the tape drive.
Status In	The tape drive returns a status byte to the initiator. The status byte indicates the results of the command's execution.

2 RDX Removable Drives

Supported SCSI Commands

The SCSI command information in this chapter references the SATA RDX device. In this document, the SATA RDX device is referred to as the *QuikStation RDX Passthrough Device* because it is passed through as RDX targets by the QuikStation. Any references to USB RDX or RDX core products can be ignored.

Table 2-1 lists the Tandberg Data RDX drive SCSI commands supported by the RDX QuikStation 4.

Table 2-1 *RDX SCSI command set*

SCSI Command	OP code	Go to...
Supported SCSI Primary Commands		
INQUIRY (6 bytes)	12h	page 4
LOG SELECT (10 bytes)	4Ch	page 14
LOG SENSE (10 bytes)	4Dh	page 15
MODE SELECT (6 bytes or 10 bytes)	15h 55h	page 28
MODE SENSE (6 or 10 bytes)	1Ah 5Ah	page 29
PREVENT/ALLOW MEDIUM REMOVAL (6 bytes)	1Eh	page 39
READ BUFFER (10 bytes)	3Ch	page 47
RELEASE (6 bytes or 10 bytes)	17h 57h	page 40
REPORT LUNS	A0h	page 40
REQUEST SENSE (6 bytes)	03h	page 41
RESERVE (6 bytes or 10 bytes)	16h 56h	page 41
TEST UNIT READY (6 bytes)	00h	page 41
WRITE BUFFER (10 bytes)	3Bh	page 47

Table 2-1 *RDX SCSI command set (continued)*

SCSI Command	OP code	Go to...
Supported SCSI Block Commands		
Format Unit	04h	page 51
Pre-fetch	34h	page 51
Read 6-byte	08h	page 52
Read 10-byte	28h	
Read Capacity 10-byte	25h	page 53
Seek	2Bh	page 51
Start Stop Unit	1Bh	page 54
Synchronize Cache	35h	page 55
Verify	2Fh	page 57
Write 6-byte	0Ah	page 55
Write 10-byte	2Ah	
Write and Verify 10-byte	2Eh	page 56
Supported SCSI Multimedia Commands		
Get Event Status Notification	4Ah	page 57

INQUIRY (12h)

The Host computer uses the INQUIRY command to retrieve information about the device. RDX supports the Standard INQUIRY Data page (see page 6), in addition to the following Vital Product Data pages listed in Table 2-2 on page 8. RDX does not support the command support data.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (12h)							
01	Reserved						Obsolete	EVPD
02	Page Code							
03	(MSB) Allocation Length							
04								(LSB)
05	Control (not supported)							

Note: Allocation length of 512 bytes is supported per SCSI SPC-3 for IDENTIFY DEVICE and other pages which require greater than 255 bytes of parameter data.

Inquiry CDB Fields

EVPD	Enable Vital Product Data	
	0	Standard inquiry data is returned.
	1	A page of vital product data is returned.
Page Code	If the EVPD bit is set to zero, the Page Code field must be zero. If the EVPD bit is set to 1, the RDX returns the supported vital product data page in this Page Code field:	
	00h	Supported Vital Product Data Pages page
	80h	Unit Serial Number page
	82h	ASCII Implemented Operating Definition page
	83h	Device Identification page
	C0h	ASCII Media Identification page
	C1h	Media Label page
	C2h	Media IDENTIFY DEVICE page
Allocation Length	The maximum amount of data (in bytes) that should be returned.If more than this is available, the amount returned is truncated to the allocation length. No error is reported.	

Standard Inquiry Data Page

When the EVPD bit is 0, the RDX returns Standard Inquiry Data, as described in the following section. Parameters listed with an "x" are unit-specific or vary with the state of the device.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier/Device Type (00h)							
01	Removable Medium (80h)							
02	Version(03h)[a]							
03	Response Data Format							
04	Additional Length (33h)							
05 **06** **07**	Reserved (00h)							
8 **...** **15**	Vendor Identification							
16 **...** **31**	Product Identification							
32 **...** **35**	Product Revision Level (x)							
36 **...** **55**	Vendor Specific							

[a] The version is not reported as SPC-2 compatible (value 04h). Instead it is listed as *03h - The device complies to ANSI X3.301:1997* in order to provide for OS compatibility with operating systems that do not accept the SPC-2 compatibility value. This is an exception to the SPC-2 standard. Vendor Identification and Product Identification fields are set during manufacturing.

Vendor-Specific Standard Inquiry Data Fields

Product Enumeration **Byte 36**	This value describes the type of RDX capable product.	
RDX Technology Field **Bytes 37-39**	A hard-coded "RDX" value to indicate this device is an RDX device.	
OEM Enumeration **Byte 40**	This value describes the OEM type corresponding to any OEM specific features of this RDX product.	
Device Support Bitmask0 **Byte 41**	This bitmask determines whether specific RDX features are supported by this firmware. Bitmask values are detailed below.	
	01h	**SupportDiskService.** This bitmask value is set to show that the device supports the RDXMon service for polling of the eject button.
	02h	**SupportPreventReconfigure.** This bitmask value is set to show the device supports appropriate non-legacy image definitions to prevent reconfiguration of OEM or product enumeration
	04h	**Support2TBDisk.** This bitmask value is set to show the device firmware supports 2TB disk.
	08h	**SupportHDDFirmwareFlashing.** This bitmask value is set to show the device supports flashing the HDD firmware inside an RDX cartridge
	10h	**SupportSkipEjectAndAutoReload**. This bitmask value is set when the device supports the skipEject and autoReload method of simulated RDX cartridge eject. Before this bitmask value was defined, some products supported skipEject but did not support autoReload used to automatically reload the cartridge.
	20h	**ContainsRDXSystemOffloadProcessor.** This bitmask value is set when the device contains an RDX system offload processor. **Note** – support for this bit was added with RDX Internal USB release 0036. Versions previous to this release contained an RSOP even though this field reported "0." This needs to be handled as a special case in software.
	40h	**SupportSmartReturnStatus.** This bitmask value is set when the device supports returning SMART RETURN STATUS results in LOG SENSE page (2Fh) Informational Exceptions.
	80h	**SupportRDXGenericWORM.** This bitmask value is set when the firmware on the device supports the RDX-WORM feature set (true for cypress firmware releases.)
Reserved **Bytes 42-55**	These fields are reserved.	

Supported Vital Product Data Pages (Page Code 00h)

When the EVPD bit is 1 and the Page Code is 00h, the RDX returns the Supported Vital Product Data page as described below. The Supported Vital Product Data Pages page is provided as specified in section 8.4.5 of SPC-2.These pages contain vendor-specific product information.

Table 2-2 *Supported Vital Product Data Pages*

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	Page Code (00h)							
02	Reserved							
03	Page Length							
04	Supported Vital Product Data page (00h)							
05	Unit Serial Number page (80h)							
06	ASCII Implemented Operating Definition page (82h)							
07	Device Identification page (83h)							
08	ASCII Media Identification page (C0h)							
09	Media Label page (C1h)							
10	Media Identify Device page (C2h)							

Unit Serial Number Page (80h)

When the EVPD bit is 1 and the Page Code is 80h, the RDX returns the Unit Serial Number page as described below. The Unit Serial Number page is provided as specified in section 8.4.6 of SPC-2.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier (00h)			Peripheral Device Type (00h)				
01	Page Code (80h)							
02	Reserved (00h)							
03	Page Length (0Ah)							
04	(MSB)							
...	Unit Serial Number (10-byte ASCII)							
13	(LSB)							

ASCII Implemented Operating Definition Page (82h)

The ASCII Implemented Operation Definition page contains operating definition description data for all operating definitions implemented by the RDX device. The ASCII Operating Definition Description Data field contains the ASCII description data for the drive. The data in this field is formatted in lines (or character strings). Each line contains only graphic codes (i.e., code values 20h through 7Eh) and is terminated with a NULL (00h) character. The text is RDX OEM/Device-specific.

ASCII Implemented Operating Definition Description Page Header Field

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier/Device Type (00h)							
01	Page Code (82h)							
02	Reserved (00h)							
03	Page Length (variable values)							

QuikStation RDX Passthrough Device ASCII Operating Definition Description Page

Field	Size	Description	Max Length[a]
Header	4	Inquiry VPD header	N/A
ASCII Length	1	Length in bytes of the ASCII Information field	Page Length -1
Image	NULL terminated	Currently executing Image	20
FW Build	NULL terminated	Constant String “FW Build:”	9
FW Date	NULL terminated	Firmware Build Date	11
FW Time	NULL terminated	Firmware Build Time	8
FW SRC	NULL terminated	Firmware SRC code tree	variable
FW Release	NULL terminated	Firmware Release version	variable
FPGA Build	NULL terminated	Constant String “FPGA Build:”	11
FPGA Rev	NULL terminated	FPGA revision name	variable
FPGA date time	NULL terminated	FPGA build date and time	variable
Last Reset	NULL terminated	Constant String “Last Reset:”	11
Last Reset cause	NULL terminated	Description of Cause of last recorded system reset	variable

[a] Since length fields are represented by bytes the sum of all max length should never be > 255 for this page. The Max length excludes the Null Terminator.

Device Identification Page (Page Code 83h)

The Device Identification page returns RDX device identifiers, including its product identifier and serial number. Parameters listed with an **x** are unit-specific.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier (00h)				Peripheral Device Type (00h)			
01	Page Code (83h)							
02	Reserved (00h)							
03	Page Length (26h or 2Eh with DOB)							
04	Code Set (ASCII) (02h)							
05	Identifier Type (first 8 bytes of vendor ID) (01h)							
06	Reserved (00h)							
07	Identifier Length (22h or 2Ah with DOB)							
08 ... 15	Vendor Identification (same data reported as Standard Inquiry Vendor ID))							
16 ... 31	Product Identification (same data reported as Standard Inquiry Product ID)							
32 ... 41	Unit Serial Number (xxxxxxxxxx)							
42 ... 49	Date of Build (date unit was manufactured) Format:ASCII characters (DDMMYYYY)							

ASCII Media Identification Data (C0h)

The ASCII Media Identification Data field contains the ASCII description data for the cartridge. The data in this field is formatted in ASCII null-terminated character strings.

When media is installed in the RDX device, the data in the following table is returned. All ASCII data fields are variable width and null terminated. Current products do not pad any fields with spaces, however future product may space-pad and left justify fields to maximum length boundaries.

The capacity, HDD Model and Serial Number values represent the raw HDD values returned through an ATA IDENTIFY DEVICE command. When available, software may use page C2h instead to access these values. The Capacity field does not support cartridge sizes larger than 2TB.

The **Max Length** column describes the maximum length of the each character string not including the null termination character.

Cartridge Mfg values are values set by the RDX cartridge manufacturer during cartridge manufacturing. These values are specified by the manufacturer.

ASCII Media Identification Data page – Cartridge Inserted

Field	Size	Description	Max Length[a]
Header	4	Inquiry VPD header (see *SCSI SPC*-2)	N/A
Length[b]	1	Length of this page not including this byte.	N/A
Title	NULL terminated	ASCII Identifier string, "Cartridge:"	10
Capacity[c]	NULL terminated	ASCII Capacity string – Limited to 8 ASCII characters	8
HDD Model	NULL terminated	ASCII HDD Model string taken from IDENTIFY DEVICE data	40
HDD Serial Number	NULL terminated	ASCII HDD Serial Number string taken from IDENTIFY DEVICE data	20
Cartridge Manufacturing Name	NULL terminated[4]	ASCII RDX Cartridge Mfg Name string	32
Cartridge Manufacturing Model Number	NULL terminated[4]	ASCII RDX Cartridge Mfg Model Number string	32
Cartridge Manufacturing Serial Number[d]	NULL terminated	ASCII RDX Cartridge Mfg Serial Number string	16

[a] Since length fields are represented by uint8's – the sum of all max length should never be > 255 for this page. Current max length is 157.

[b] This length is a duplicated length byte in addition to the one in the header, however it will always be 1 byte less than the byte count value in the header since this byte is included in the header length but not in the length calculation for the byte.

[c] Capacity field will not be accurate for cartridges > 2TB in size. Use the C2h page (or READ CAPACITY) instead when available.

[d] Cartridge Manufacturing Bar code only available when Cartridge is read in SATA or RDXCode RDX devices.

ASCII Media Identification Data Page – Cartridge Not Inserted

Field	Size	Description	Max Length
Header	5	Inquiry VPD header (see *SCSI SPC-2*)	N/A
Title	NULL terminated	ASCII Identifier string, "Cartridge:"	10
No Cartridge Identifier String	NULL terminated	ASCII Identifier string, “none”	4

Since the C0h page in some cases returns “none” for cartridge information when a failed cartridge is inserted this page should not be used for cartridge diagnostic purposes. Instead The TEST UNIT READY Command (00h) (page 41) may be used to check for a damaged cartridge inserted and the LOG SENSE Cartridge Info Log Page (21h) (page 19) may be used to check for the presence/reason for a cartridge LED error state.

Media Label Page (C1h)

The Media Label page returns the volume label of an installed RDX cartridge. This page is always available for reading, even for inauthentic cartridges. This data gets displayed in the GUI for InfiniVault, even if the cartridge is inauthentic.

Support for the C1h Media Label page may be removed in later revisions of firmware at Tandberg Data’s discretion.

Support for the C1h Media Label page was included in SATA release 0044.

The format of this page when a cartridge is present is shown in the following table.

Media Label page with Cartridge Installed

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier/Device Type (00h)							
01	Page Code (C1h)							
02	Reserved (00h)							
03	Page Length (81h)							
04	Length (80h)							
05 **...** **132**	Volume Label[a] [b]							

[a] If a volume label has never been set on a cartridge the data returned is 128 bytes of all 00h

[b] Unicode media labels are returned in little endian format. For instance an ‘R’ character in Unicode would typically be represented by 0052 but instead is returned 5200 in the parameter data field.

Media Label Page with No Cartridge Installed

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier/Device Type (00h)							
01	Page Code (C1h)							
02	Reserved (00h)							
03	Page Length (01h)							
04	Length (00h)							

Media Identify Device Page (C2h)

The Media IDENTIFY DEVICE page returns the raw data taken from the IDENTIFY DEVICE command issued to an installed RDX cartridge.

This page was supported by RDX SATA beginning with firmware release 0050. All data will be word-swapped if necessary to return in big endian word format (for historical reasons.) Multi-word integer fields need to be word-swapped on the host side before reading as little endian words. Single word fields may be read as big endian words. ASCII character arrays SERIAL NUMBER, MODEL NUMBER and FIRMWARE REVISION fields do not need to be word-swapped.

Refer to the T13 specification for the contents and format of the ATA IDENTIFY DEVICE response data.

The device may send either a cached version (read on the last cartridge load) or a current version (read during SCSI command processing) of the IDENTIFY DEVICE data.

If an attempt to send the ATA IDENTIFY DEVICE command to the HDD fails as part of this command processing, firmware shall respond with CHECK CONDITION status, with the sense key set to HARDWARE ERROR and the additional sense code set to INTERNAL TARGET FAILURE (02/44/00.)

Request at least 0x204 bytes when querying this page. When using a smaller request length on the SATA product, the results of the page may be indeterminate.

RDX Device Media Identify Device Data Format

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier/Device Type (00h)							
01	Page Code (C2h)							
02	Page Length (200h)							
03								
04 **...** **515**	Identify Data							

Notes: If a request for this page is issued when the RDX drive is in a state other than READY, firmware will respond with a CHECK CONDITION and the appropriate ASC/ASCQ.

On receipt of this command, firmware will return all 512 bytes of the IDENTIFY DEVICE data returned from the installed RDX cartridge.

LOG SELECT (4Ch)

The Host computer uses the LOG SELECT command to manage statistics about cartridge usage and error rates. The Host computer may reset statistics or set them to their default values. Various counters are also reset by power-on, reset, or a cartridge load operation.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (4ch)							
01	Reserved						PCR (1)[a]	SP
02	PC (not supported)		Page Code[b]					
03 **…** **06**	Reserved							
07	(MSB)		Parameter List Length[c]					
08								(LSB)
09	Control (not supported)							

[a] PCR must be set to 1, use of this command with PCR = 0 will have no effect.

[b] Supported on RDXCore products.

[c] Parameter list length should always be 4 if the Page Code is not specified.

Note: Issuing a Log Select command to Log page 0 resets all resetable parameters in all pages with the exception of drive information page (see page 17) Issuing a Log Select command to a specific Log page resets only the parameters on that page.

Log Select Page Header Data

This header must be sent when the LOG SELECT command is issued to the device.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Page Code (specific page code or 00hto reset all pages)							
01	Reserved (00h)							
02	Page Length (00h)							
03								

LOG SENSE (4Dh)

The Host computer uses the LOG SENSE command to retrieve statistics about cartridge usage and error rates. This command is complimentary to the LOG SELECT command.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (4Dh)							
01	Reserved						PPC[a]	SP[b]
02	PC[c] (not supported)		Page Code					
03	Reserved							
04								
05	(MSB)	Parameter Pointer[d] (not supported)						(LSB)
06								
07	(MSB)	Allocation Length						(LSB)
08								
09	Control (not supported)							

[a] The Parameter Pointer Control (PPC) bit is ignored.

[b] Not supported.

[c] Page Control (PC) field is ignored.

[d] Parameter Pointer field is ignored.

Supported Log Pages

Byte \ Bit	7	6	5	4	3	2	1	0
00	Reserved		Page Code (00h)					
01	Reserved							
02	(MSB)		Page Length					(LSB)
03								
04	Supported Log Pages log page (00h)							
05	Write Error Counter log page (02h)							
06	Read Error Counter log page (03h)							
07	Temperature log page (0Dh)							
08	Self-test results log page (10h))							
09	Drive info log page (vendor unique) (20h)[a]							
10	Cartridge info log page (vendor unique) (21h)[b]							
11	Informational Exceptions log page (2Fh)							
12	RDX Error Events log page (vendor unique OEM feature) (33h)							

[a] Vendor unique log page 0x20 is not included in the Supported Log Pages log page (00h) for historical reasons..

[b] Vendor unique log page 0x21 is not included in the Supported Log Pages log page (00h) for historical reasons..

Supported Log Pages Log Page (00h)

Supported Log Pages are returned as described in *SPC-2* section 8.2.10. Each RDX device returns only those pages supported by that device as described in in the above Supported Log pages table and the following log page sections. Pay special attention to footnotes a and b in relation to log pages 0x20 and 0x21.

Write Error Counter Log Page (02h)

Write Error Counter values are returned as described in *SPC-2* section 8.2.4. Parameter Codes 0000h-0006h are returned. Currently only Parameter Code 0005h (Total bytes processed) has an actual value, all other Parameter Codes have zero values.

Read Error Counter Log Page (03h)

Read Error Counter values are returned as described in *SPC-2* section 8.2.4. Parameter Codes 0000h-0006h are returned. Currently only Parameter Code 0005h (total bytes processed) has an actual value, all other Parameter Codes have zero values.

Temperature Log Page (0Dh)

Temperature logs are returned as described in *SPC-2* section 8.2.11. Only Parameter Code 0000h temperature is returned.

The temperature returned in this page reflects the temperature of the RDX cartridge and therefore is only available when a cartridge is installed and has not spun-down. Per the *SPC-2* specification, this page will return FFh when a cartridge is not installed in the RDX device (since temperature is not available.) When the cartridge has spun down, the value returned will be FFThe value FFh will also be returned if temperature is not reported by the HDD inside the RDX cartridge.

Self-Test Results Log Page (10h)

Self-Test Results are returned as described in *SPC-2* section 8.2.8. The values returned in this log page are based on the results of the last self test executed with SEND DIAGNOSTIC.

The table below lists the Additional Sense Code and Additional Sense Code Qualifiers that could be returned in the Self-test Log Results page.

Table 2-3 *Self-test ASC/ASCQ*

ASC	ASCQ	Description
00	00	Self Test passed
0C	00	Write error
11	00	Unrecovered Read error
27	00	Media Write Protected
30	00	Incompatible Medium Installed
30	0C	WORM Medium – Overwrite Attempted
40	80	POST Failure
40	81	Cartridge Eject Failure
40	82	Firmware Image Corrupt
40	90	Cartridge not Authentic
40	91	Cartridge Fails to Come Ready
40	92	HDD Self-Test Failure
44	00	Internal Target Failure
52	00	Cartridge Fault

Drive Info Log Page (20h)

Log page 20h is a vendor unique log page that returns information about the drive. The table below describes the format of the data returned.

Table 2-4 *Drive Info log page data*

Byte	Description	Value
20h	Page Code	0
00h	Reserved	1
0022h	Page Length	2-3
0000h	Parameter Code	4-5
60h	DU/DS/ETC/TMC/LBIN/LP	6
02h	Parameter Length	7
0=no errors 1=errors exist	Drive Status	8-9
001h	Parameter Code	10-11
60h	DU/DS/ETC/TMC/LBIN/LP	12
04h	Parameter Length	13
xxxx	Cartridge Load Count	14-17
0002h	Parameter Code	18-19
60h	DU/DS/ETC/TMC/LBIN/LP	20
04h	Parameter Length	21
see Table 2-5	Button LED Reasons	22-25
0003h	Parameter Codes	26-27
60h	DU/DS/ETC/TMC/LBIN/LP	28
02h	Parameter Length	29
00h	Reserved	30
0=CAM not at home 1= CAM is at home	CAM Sensor Status	31
0004h	Parameter Codes	32-33
60h	DU/DS/ETC/TMC/LBIN/LP	34
02h	Parameter Length	35
00h	Reserved	36

Button LED Reasons

The Button LED Reasons describe error conditions that will turn the drive LED amber. The following enumeration defines the bit positions that indicate the error:

Table 2-5 *Button LED Reasons*

Byte \ Bit	7	6	5	4	3	2	1	0
22	Reserved							
23								
24								
25	Reserved			Firmware Image Bad	Eject Failed	Firmware Assertion Failed	Link Down Detected	POST Failed

Cartridge Info Log Page (21h)

Log page 21h is a vendor unique log page that returns information about the cartridge. The table below describes the format of the data returned.

Note: Issuing this command with no media inserted in the RDX device will cause the command to fail with CHECK CONDITION status, with the sense key set to NOT READY, and the additional sense code set to MEDIUM NOT PRESENT (02/02/3A00).

Table 2-6 *Cartridge Info log page data*

Byte	Description	Value
21h	Page Code	0
00h	Reserved	1
003Eh or 004Eh w/PC 0008 & 0009	Page Length	2-3
0000h	Parameter Code	4-5
60h	DU/DS/TSD/ETC/TMC/LBIN/LP	6
02h	Parameter Length	7
0 = No Errors 1 = Errors Exist	Cartridge Status	8-9
0001h	Parameter Code	10-11
60h	DU/DS/TSD/ETC/TMC/LBIN/LP	12
04h	Parameter Length	13
see page 21	Cartridge Load Count	14-17

Table 2-6 *Cartridge Info log page data (continued)*

Byte	Description	Value
0002h	Parameter Code	18-19
60h	DU/DS/TSD/ETC/TMC/LBIN/LP	20
04h	Parameter Length	21
see page 21	Cartridge Capacity (in MB)	22-25
0003h	Parameter Code	26-27
60h	DU/DS/TSD/ETC/TMC/LBIN/LP	28
04h	Parameter Length	29
see page 21	Free Space (in MB)	30-33
0004h	Parameter Code	34-35
60h	DU/DS/TSD/ETC/TMC/LBIN/LP	36
04h	Parameter Length	37
see page 21	Used Space (in MB)	38-41
0005h	Parameter Code	42-43
60h	DU/DS/TSD/ETC/TMC/LBIN/LP	44
04h	Parameter Length	45
xxxx	Cartridge Data Written (in MB)	46-49
0006h	Parameter Code	50-51
60h	DU/DS/TSD/ETC/TMC/LBIN/LP	52
04h	Parameter Length	53
xxxx	Cartridge Data Read (in MB)	54-57
0007h	Parameter Code	58-59
60h	DU/DS/TSD/ETC/TMC/LBIN/LP	60
04h	Parameter Length	61
see Table 2-7 on page 22	Cartridge Error LED Reasons	62-65
0008h	Parameter Code	66-67
60h	DU/DS/TSD/ETC/TMC/LBIN/LP	68
04h	Parameter Length	69
See page 22	Cartridge Software Write Protect	70-73
0009h	Parameter Code	74-75
60h	DU/DS/TSD/ETC/TMC/LBIN/LP	76
04h	Parameter Length	77
see page 22	Cartridge Software Read Protect	78-81

Cartridge Load Count

Cartridge load count is updated upon the eject of the cartridge from the RDX device. Load count is incremented on eject instead of insert to prevent additional increment due to power cycle or reset conditions which are difficult to differentiate from insert. The count is supposed to be an indicator of connector wear; therefore this count attempts to capture only real insertions of the cartridge. Emergency-ejected cartridges are not included in load counts.

Note: All released version of SATA RDX device firmware prior to version 0050 updated this count upon insert of the cartridge. SATA RDX device code was modified with CR5940 to update the load count upon eject of the cartridge to match the operation of the USB RDX device. Updating this count upon eject of the cartridge has the added benefit of keeping synchronized with the Drive Info log page (20h), Cartridge Load Count, which is updated upon eject of the cartridge.

OEM's may use this count to determine if a customer returned cartridge was ever used (inserted into a RDX device) by a customer.

Cartridge Capacity in MB

This field will not support > 2TB cartridges and is deprecated. New host software should not use this field. Instead, calculate cartridge capacity using the results of READ CAPACITY and the BLOCK LENGTH value returned in the MODE SENSE block descriptor described on page 31.

Alternatively, use the OS file system operations to calculate cartridge capacity instead.

Legacy product returned a base 10 MB calculation of cartridge capacity in this field (10^6) bytes.

Used Space and Free Space

Used Space and Free Space values are not valid on current RDX removable disk products and should not be used. Use the file system operations for your operating system to determine cartridge used and free space.

Cartridge Data Written/Data Read

The data written and data read counts return the number of MiB (base 2 MB or 2^20) read or written on the cartridge since the cartridge was created at the factory.

Cartridge Error LED Reasons

Cartridge error LED reasons describe error conditions that will turn the cartridge LED amber. The following enumeration defines the bit positions that indicate the error:

Table 2-7 *Cartridge error LED reasons*

Byte \ Bit	7	6	5	4	3	2	1	0
62	Reserved							
63								
64								
65	Password Protect	Tape Format Cartridge	Overwrite Prevent	Write Error	Read Error	Damaged Cartridge	Incompatible Medium	Inauthentic Cartridge

Cartridge Software Read and Write Protect

The Cartridge software read and write protect parameters indicate whether a write or read protect is enabled by RDX cartridge metadata. Any non-zero value in this field indicates a write or read protect is set on the cartridge. This may limit access to specific types of RDX dock firmware.

Cartridge Info Log Page Media Error State Handling

The cartridge info log page is returned in all final (i.e. non transition) media states other than no media.

Warning: In states IncompatibleMedium, and DamagedCartridge some or all of the metadata fields (Cartridge Load Count, Data Read, Data Written) may not be valid. Software should consider these values unreliable when the cartridge status field shows that errors exist or “Cartridge LED Reasons” field is set to a non-zero value.

Informational Exceptions log page (2Fh)

SMART READ DATA is returned as vendor unique Parameter Code (FFFFh). Either 0 or 512 bytes of SMART READ DATA is returned. The data returned is in response to a SMART READ DATA command issued to the cartridge HDD. See the HDD manufacturer documentation for the format of the SMART READ DATA.

SMART RETURN STATUS results are returned in bytes 8 and 9 of the Parameter Code (0000h) field. The data returned is in response to a SMART RETURN STATUS command issued to the cartridge HDD (for more details, see the Draft ATA/ATAPI-7 Standard). The SMART RETURN STATUS results are based on the results mapping shown in the table below.

Table 2-8 *Smart Return Status results mapping*

Results	Status	Information Exception
LBA Mid = 4Fh LBA High = C2h	Threshold not exceeded	ASC = 00h ASCQ = 00h
LBA Mid = F4h LBA High = 2Ch	Threshold exceeded	ASC = 5Dh ASCQ = 10h
No Cart, Cart Spun Down OR Any SMART failure	Indeterminate	ASC = 00h ASCQ = 00h

Notes: SMART READ DATA and SMART RETURN STATUS are only available when the cartridge is present and the cartridge HDD is spinning. If there is no cartridge or the cartridge is spun down then SMART READ DATA returns 0 bytes and SMART RETURN STATUS results are mapped to 00h (Indeterminate).

Issuing the Information Exceptions LOG SENSE command with no media inserted in the RDX device will cause the command to fail with CHECK CONDITION status, with the sense key set to NOT READY, and the additional sense code set to MEDIUM NOT PRESENT (02/02/3A00).

Earlier releases allowed this command with no media. Results of issuing this command without media installed are undefined.

Informational Exceptions Log Page Data

Table 2-9 *Cartridge Info log page data*

Byte	Description	Value
2Fh	Page Code	0
00h	Reserved	1
000Ch or 020Ch	Page Length	2-3
0000h	Parameter Code	4-5
03h	DU/DS/TSD/ETC/TMC/LBIN/LP	6
04h	Parameter Length	7
See Table 2-8 on page 23	Informational Exception Additional Sense Code	8
See Table 2-8 on page 23	Informational Exception Additional Sense Code Qualifier	9
See page 16	Most Recent Temperature Reading	10
00h	Reserved	11
FFFFh	Parameter Code (SMART data)	12-13

Table 2-9 *Cartridge Info log page data*

Byte	Description	Value
03h	DU/DS/TSD/ETC/TMC/LBIN/LP	14
00h	Parameter Length (always zero – the Page Length in bytes 2-3 will indicate if SMART data is available)	15
Available if cart present and spinning	SMART data (if available)	16-527

RDX Error Events Log Page (33h)

Note: The RDX Error events log page is only supported on specific RDX firmware builds. When the RDX Error Events log page is not supported due to software or hardware restrictions, issuing a LOG SENSE command for page 33 will return CHECK CONDITION with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB (02/05/2400.)

The RDX Error Events log page returns information about any CHECK CONDITION status severe enough to cause user visible errors. This page contains a maximum of eight entries. Parameter Codes with smaller numbers indicate events that happened earlier in time. Earlier Parameter Codes are overwritten if more than eight error events accumulate. The log stops filling when the Parameter Code value reaches FFFFh leaving the last eight errors intact (FFF8h-FFFFh). If the same error happens repeatedly, the Error Repeat Count field will be incremented up to a maximum of FFh. Whenever the log is cleared via the LOG SELECT command, log operations continue starting with Parameter Code 0001h.

Note: The definition of a repeated error for which the Error Repeat Count is incremented rather than creating a new error entry is that bytes 2-22 of the RDX Error Events log page parameter match the last posted error.

This page begins with a 4-byte header followed by the log parameter blocks.

RDX Error Events Log Page Header.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Page Code (33h)							
01	Reserved (00h)							
02	Page Length (18h x number of errors - up to C0h max)							
03								

Error Events Log Page – Log Parameter Format

Byte \ Bit	7	6	5	4	3	2	1	0
00	Parameter Code							
01								
02	DU/DS/TSD/ETC/TMC/LBIN/LP (61h)							
03	Parameter Length							
04	Cartridge Serial Number							
…								
19								
20	Sense Keys							
21	Additional Sense Codes							
22	Additional Sense Code Qualifier							
23	Error Repeat Count							

Error Events Log Page Fields

Parameter Code	Code values from 0001h – FFFFh are valid. Error events are logged starting at Parameter Code 0001h and event logging stops when Parameter Code FFFFh is reached. Logging continues at Parameter Code 0001h whenever this log page is cleared via LOG SELECT.
Cartridge SN	Cartridge Serial Number. This field is only valid for cartridge error conditions. For Cartridge Error conditions, this field contains a 16 character ASCII string, otherwise field contains zeros.
Sense Key	Sense Key. See Table 2-10 on page 26.
ASC	Additional Sense Code. See Table 2-10 on page 26.
ASCQ	Additional Sense Code Qualifier. See Table 2-10 on page 26.
Error Repeat Count	Number of times this same error has been seen consecutively.

Several common Sense Key values that are detected by the RDX device, and may be noticed by host applications, are not reported in the Error Events Log. They are not reported because they are commonly occurring errors. These include Sense codes 00h, 02h, 05h, and 06h. A flood of these errors could fill up the log, and are not useful for diagnosis of RDX device or cartridge failures.

Table 2-10 lists all possible combinations of Sense Key, ASC, and ASCQ detected in the RDX. Those that are included in the Error Events Log are marked ‘Yes’ in the last column.

Several common Sense Key values that are detected by the RDX device, and may be noticed by host applications, are not reported in the Error Events Log. They are not reported because they are commonly occurring errors. These include Sense codes 00h, 02h, 05h, and 06h. A flood of these errors could fill up the log, and are not useful for diagnosis of RDX device or cartridge failures.

Table 2-10 *Sense Key/ASC/ASCQ Detected in RDX*

Sense Key	ASC	ASCQ	Description	Included in Error Log?
00h			**No Sense**	
00h	00h	00h	Deferred Error pending	
00h	00h	18h	Erase Operation In Progress	
02h			**Not Ready**	
02h	3Ah	00h	Media not present	
02h	04h	00h	Logical Unit not ready, cause not reportable	

Table 2-10 *Sense Key/ASC/ASCQ Detected in RDX (continued)*

Sense Key	ASC	ASCQ	Description	Included in Error Log?
02h	04h	01h	Logical Unit in process of becoming ready	
02h	04h	02h	Logical Unit not ready, initializing command required	
02h	04h	03h	Logical Unit not ready, manual intervention required	
02h	04h	07h	Logical Unit not ready, operation in progress	
03h			**Medium Error**	
03h	0Ch	00h	Write error	Yes
03h	11h	00h	Unrecovered Read error	Yes
03h	11h	0Ah	Miscorrected Error	Yes
03h	15h	00h	Random Positioning Error	Yes
03h	30h	00h	Incompatible Medium Installed	Yes
03h	52h	00h	Cartridge Fault	Yes
04h			**Hardware Error**	
04h	3Eh	03h	Logical Unit Failed Self-Test	Yes
04h	3Fh	01h	Flash programming failed	Yes
04h	40h	80h	POST Failure	Yes
04h	40h	81h	Eject Failure	Yes
04h	40h	82h	Firmware Image Corrupt	Yes
04h	40h	83h	Data Buffer RAM Failure	Yes
04h	40h	90h	Cartridge Not Authentic	Yes
04h	40h	91h	Cartridge Fails to Come Ready	Yes
04h	40h	92h	HDD Self Test Failure	Yes
04h	40h	NNh	Diagnostic Failure on Component NN (80h-FFh)	Yes
04h	44h	00h	Internal Target Failure	Yes
05h			**Illegal Request**	
05h	20h	00h	Invalid Command OPERATION CODE	
05h	21h	00h	Logical Block Address Out Of Range	
05h	24h	00h	Invalid field in CDB	
05h	25h	00h	Logical Unit Not Supported	
05h	26h	00h	Invalid field in parameter list	
05h	26h	01h	Parameter not Supported	
05h	2Ch	00h	Command Sequence Error	

Table 2-10 *Sense Key/ASC/ASCQ Detected in RDX (continued)*

Sense Key	ASC	ASCQ	Description	Included in Error Log?
05h	39h	00h	Saving Parameters Not Supported	
05h	53h	02h	Medium Removal Prevented	
05h	67h	00h	Configuration Failure (SATA protocol failure)	
06h			**Unit Attention**	
06h	28h	00h	Not ready to ready change, medium may have changed	
06h	29h	00h	Power on, reset, or bus device reset occurred	
06h	29h	01h	Power on occurred	
06h	29h	02h	SCSI bus reset occurred	
06h	29h	03h	Bus device reset function occurred	
06h	29h	04h	Device internal reset	
06h	3Fh	01h	Microcode has been changed	
06h	5Ah	01h	Operator media removal request	
06h	5Bh	01h	Threshold condition met	
07h			**Data Protect Errors**	
07h	27h	00h	Media Write Protected	Yes
07h	30h	02h	Cannot Read Medium - Incompatible Format	Yes
07h	30h	05h	Cannot Write Medium - Incompatible Format	Yes
07h	30h	0Ch	WORM Medium – Overwrite Attempted	Yes
0Bh			**Aborted Command Errors**	
0Bh	08h	03h	LUN Comm Error, Bus CRC Error	Yes
0Bh	4Eh	00h	Overlapped Commands Attempted	Yes

MODE SELECT (15h or 55h)

The Host computer uses the MODE SELECT command to assign specific parameters to the device. RDX supports both the 6-byte and 10-byte versions of this command. This command is complimentary to the MODE SENSE command.

Note: Although all RDX devices support this command, most do not allow the Host computer to change any parameters. In other words, for most firmware versions there are no changeable values and RDX ignores any mode pages sent by the Host computer. One exception is the Write Caching page, see page 34 for more details.

Mode Select Six-byte CDB (15h)

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code							
01	Reserved			PF[a]	Reserved			SP[b]
02	Reserved							
03								
04	Parameter List Length							
05	Control (not supported)							

[a] PF must be set to 1

[b] SP must be set to 0

Mode Select Ten-byte CDB (55h)

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code							
01	Reserved			PF[a]	Reserved			SP[b]
02 … **06**	Reserved							
07	(MSB) Parameter List Length							
08	(LSB)							
09	Control (not supported)							

[a] PF must be set to 1

[b] SP must be set to 0

MODE SENSE (1Ah or 5Ah)

The Host computer uses the MODE SENSE command to retrieve specific parameters from the device. RDX supports both the 6-byte and 10-byte versions of this command. This command is complimentary to the MODE SELECT command.

The formats for the CDB, Mode parameter list, Mode parameter header, Block descriptor, and Mode pages are specified by *SPC-2* and *SBC-2*. The following sections describe the usage for each of these lists.

Mode Sense Six-byte CDB (1Ah)

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code(1Ah)							
01	Reserved				DBD[a]	Reserved		
02	PC[b]		Page Code					
03	Reserved							
04	Allocation Length							
05	Control (not supported)							

[a] If DBD is set, no block descriptions are returned.

[b] Supported Page Control (PC) fields are: 00b=current values, 01b= changeable values, 10b= default values.

Mode Sense Ten-byte CDB (5Ah)

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (5Ah)							
01	Reserved			LLBAA	DBD[a]	Reserved		
02	PC[b]		Page Code					
03 … 06	Reserved							
07	(MSB) Allocation Length							
08								(LSB)
09	Control (not supported)							

[a] If DBD is set, no block descriptions are returned.

[b] Supported Page Control (PC) fields are: 00b=current values, 01b= changeable values, 10b= default values.

Mode Sense Parameter Header — Six-byte

Byte \ Bit	7	6	5	4	3	2	1	0
00	Mode Data Length							
01	Medium Type[a]							
02	Device-Specific Parameter (see page 31)							
03	Block Descriptor Length							

[a] Medium Type should be set to 0 on Mode Select commands.

Mode Sense Parameter Header — Ten-byte

Byte \ Bit	7	6	5	4	3	2	1	0
00	(MSB) Mode Data Length							
01								(LSB)
02	Medium Type[a]							
03	Device-Specific Parameter (see Table on page 31)							
04	Reserved							LongLBA[b] (not supported)
05	Reserved							
06	(MSB) Block Descriptor Length							
07								(LSB)

[a] Medium Type should be set to 0 on Mode Select commands.

[b] LongLBA bit should be set to 0 on Mode Select commands.

Mode Parameter Device-Specific Parameter Field

	7	6	5	4	3	2	1	0
	WP[a]	Reserved		DPOFUA (not supported)	Reserved			

[a] When returned by MODE SENSE, the WP bit indicates the write protected status of the cartridge. When WP is set a write protect is set on the cartridge via switch or software. This bit is ignored in a MODE SELECT command.

Mode Parameter Block Descriptor

The block descriptor, when included with MODE SENSE is always the Short LBA version as documented in SBC-2 section 6.3.2.2.

Mode Parameter Short LBA Block Descriptor

Byte \ Bit	7	6	5	4	3	2	1	0
00	(MSB)							
…	Number of Blocks[a]							
03								(LSB)
04	Reserved							
05	(MSB)							
…	Block Length[b]							
07								(LSB)

[a] NUMBER OF BLOCKS field is ignored when sent through MODE SELECT. The value returned by MODE SENSE is accurate.

[b] BLOCK LENGTH field is ignored when sent through MODE SELECT. The value returned by MODE SENSE is accurate and represents the number of bytes in each logical block of the installed cartridge.

QuikStation RDX Passthrough Device-Supported Mode Pages

The QuikStation RDX Passthrough device accepts the Mode pages listed in the table below.

Mode Page	Page Code
Read-Write Error Recovery Mode page	01h
Disconnect-Reconnect page	02h
Caching Mode page	08h
Control Mode page	0Ah
Informational Exceptions Control page	1Ch
RDX Features Mode page[a]	31h
All Pages[b]	3Fh

[a] RDX Features Mode page is not included when ‘all pages’ (3Fh) is requested.

[b] Refer to SPC-2 for information about the All Pages mode page.

Read-Write Error Recovery Mode Page (01h)

The Read-Write Error Recovery Mode page is described in *SBC-2* section 6.3.4. RDX firmware does not support changeable parameters on this page.

Table 2-11 *Read-Write Error Recovery Mode Page*

Byte	Description	Value
01h	Bit 0-5: Page Code	0
0b	Bit 6: Reserved	
0b	Bit 7: Parameters Savable (PS)	
0Ah	Page Length	1
08h	AWRE/ARRE/TB/RC/EER/PER/DTE/DCR	2
FFh	Read Retry Count	3
000000h	Obsolete	4-6
00h	Reserved	7
FFh	Write Retry Count	8
00h	Reserved	9
0000h	Recovery Time Limit	10-11

Disconnect-Reconnect Page (02h)

The Disconnect-Reconnect page is described in *SPC-2* section 8.3.7. RDX firmware does not support changeable parameters on this page.

Table 2-12 *Disconnect-Reconnect page data*

Byte	Description	Value
02h	Bit 0-5: Page Code	0
0b	Bit 6: Reserved	
0b	Bit 7: Parameters Savable (PS)	
0Eh	Page Length	1
00h	Buffer Full Ratio	2
00h	Buffer Empty Ratio	3
0000h	Bus inactivity Limit	4-5
0000h	Disconnect Time Limit	6-7
0000h	Connect Time Limit	8-9
0000h	Maximum Burst Size	10-11
00h	EMDP/Fair Arbitration/DIMM/DTDC	12

Table 2-12 *Disconnect-Reconnect page data*

Byte	Description	Value
00h	Reserved	13
00h	First Burst Size	14-15

Flexible Disk Mode Page (05h)

The Flexible Disk Mode page is not supported by SATA products.

RDX firmware does not support changeable parameters on this page.

Table 2-13 *Flexible Disk Mode page data*

Byte	Description	Value
05h	Bit 0-5: PAGE CODE	0
0b	Bit 6: Reserved	
0b	Bit 7: Parameters Savable (PS)	
1Eh	Page Length	1
00h	Reserved	2
00h	Reserved	3
10h	Number of Heads	4
3Fh	Sectors Per Track (	5
02003Fh	Bytes per Sector	6-8
FFh	Number of Cylinders	9
00h	Reserved	10-31

Caching Mode Page (08h)

The Caching Mode page is described in *SBC-2* section 6.3.3.

An OEM build specific option, WriteCacheCtl, determines how RDX responds to the MODE SELECT COMMAND for the Caching Mode page.

WriteCacheCtl = 0: RDX does not allow the Host computer to change any parameters. In other words, there are no changeable values. RDX ignores any Mode pages sent by the Host computer.

WriteCacheCtl = 1: The only changeable value that the RDX supports is the Writeback Cache Enable bit in the Caching Mode page (08h).

Table 2-14 *Caching Mode page data*

Byte	Description	Value
08h	Bit 0-5: Page Code	0
0b	Bit 6: Reserved	
0b	Bit 7: Parameters Savable (PS)	
12h	Page Length	1
see Table on page 35	IC/ABPF/CAP/DISC/SIZE/WCE/MF/RCD	2
00h	Demand Read Retention Priority/Write retention Priority	3
0200h	Disable Pre-Fetch Transfer Length	4-5
0100h	Minimum Pre-Fetch	6-7
0200h	Maximum Pre-Fetch	8-9
0200h	Maximum Pre-Fetch Ceiling	10-11
00h	FSW/LBCSS/DRA/Vendor specific/Reserved/NV_DIS	12
E2h	Number of Cache Segments	13
0000h	Cache segment Size	14-15
00h	Reserved	16
000000h	Obsolete	17-19

Caching Mode page WCE Control

Bit	7	6	5	4	3	2	1	0
	(not supported)					WCE[a]	(Not Supported)	

[a] The value returned in this bit through a MODE SENSE request correctly reflects the current state of write caching set on the RDX cartridge. If WriteCacheCtl feature is enabled as an OEM feature this bit can be used through MODE SELECT to disable write caching on disk. Performance typically drops to below 5 MB/s when write caching is disabled on disk.

Control Mode Page (0Ah)

The Control Mode page is described in *SPC-2* section 8.3.6. RDX firmware does not support changeable parameters on this page.

Table 2-15 *Control Mode page data*

Byte	Description	Value
0Ah	Bit 0-5: Page Code	0
0b	Bit 6: Reserved	
0b	Bit 7: Parameters Savable (PS)	
0Ah	Page Length	1

Table 2-15 *Control Mode page data*

Byte	Description	Value
00h	TST/reservd/GLTSD/RLEC	2
00h	QUEUE Algorithm Modifier/reserved/QERR/DQUE	3
00h	TAS/RAC/Reserved/SWP/RAERP/UAAERP/EAERP	4
00h	Reserved/Autoload Mode	5
0000h	Ready AER Holdoff Period	6-7
0000h	Busy Timeout Period	8-9
0000h	Extended Selftest Completion Time	10-11

Informational Exceptions Control Page (1Ch)

The Informational Exceptions Control page is described in *SPC-2* section 8.3.8. RDX firmware does not support changeable parameters on this page.

Table 2-16 *Informational Exceptions Control page data*

Byte	Description	Value
0Ch	Bit 0-5: Page Code	0
0b	Bit 6: Reserved	
0b	Bit 7: Parameters Savable (PS)	
0Ah	Page Length	1
08h	PERF/Reserved/EBF/EWASC/DEXCPT/TEST/Reserved/LOG ERR	2
03h	Reserved/MRIE	3
000000h	Interval Timer	4-7
00000000h	Report Count	8-11

RDX Features Mode Page (31h)

The RDX Features Mode page controls the set and query of RDX specific features.

Table 2-17 *RDX Features Mode page data*

Byte	Value	Bit	Field	Description
Byte 0 - Byte 1: Mode Page Header				
0	31h	Bit 0-5	Page Code	
	0b	Bit 6	Reserved	
	Xb	Bit 7	Parameters Savable	The PS bit should be set on a mode select command to indicate parameters need saving. The PS bit is currently ignored on QuikStation RDX Passthrough devices, however it should be set when mode select is sent for compatibility with future devices.
1	Xxh		Page Length	
2-3	0000h		Reserved	
Byte 4: Features Select				
4[a]	xb	Bit 0	allowFormatChange	Used with cartridge format meta changes – this field is for Tandberg Data use only.
	xb	Bit 1	readVerify	This field is for Tandberg Data use only.
	xb	Bit 2	forceLoadFormatUpdate	This field is for Tandberg Data use only.
	Two bits in the RDXFeatures Mode page control the skipEject functionality of RDX firmware. These bits are the skipEject and autoReload bits. These bits are used to simulate a cartridge eject before a firmware update of the RDX device or HDD. By simulating an eject, firmware ensures the host is not attempting to access an installed cartridge during an update process. This allows updates to occur without ejecting the cartridge (and allows HDD firmware updates of cartridges.)			
4	xb	Bit 3	skipEject	The intention of this bit is to allow firmware download without ejecting the cartridge. The RDX device tricks the OS into believing the media has been ejected when it in fact is still installed. ▸ The button eject should be disabled when a cartridge is in this stateThe state of cartridge polling/cartridge LED/etc is undefined and may vary by implementation. ▸ The Firmware should not reject START STOP UNIT when in this state. ▸ Support: SATA – Build 50 and later.

***Table 2-17** RDX Features Mode page data (continued)*

Byte	Value	Bit	Field	Description
4	xb	Bit 4	autoReload	The autoReload feature simulates an unload/reload sequence to allow the host to correctly reprocess media (or new media write protects.) The "reload" will automatically happen a few seconds after the START STOP UNIT is sent. ▸ Support: SATA – Build 52 and later.
4	000b	Bit 5-7	reserved	Firmware shall reject any reserved bits set in features select byte 1 with CHECK CONDITION status Illegal Request, INVALID PARAMETER LIST (02/05/2600).
5	xxh		currentFormat	This field deals with metadata formats and is Tandberg Data Proprietary.
6	xxh		loadFormat	This field deals with metadata formats and is Tandberg Data Proprietary.
7	00h		Reserved	
8	xb	Bit 0	passwordChange	
	xb	Bit 1	passwordCheck	
	xb	Bit 2	Unlock	
	xb	Bit 3	prepareErase	
	xb	Bit 4	Erase	
	xb	Bit 5	maxAttemptLock	
	00b	Bit 6-7	Reserved	
	Byte 9 - 79: Password Support			
	These bytes were originally reserved for a password support feature. The bits are reserved for future use.			
9-11	00h		Reserved	
12	xb	Bit 0	passwordSet	
	0000000b	Bit 1-7	Reserved	
13	00h		Reserved	
14	20h		passwordLength	Deprecated. QuikStation RDX Passthrough device reports 20h to indicate maximum length of the password.
15	20h		hintLength	Deprecated. QuikStation RDX Passthrough device reports 20h to indicate maximum length of the password.

***Table 2-17** RDX Features Mode page data (continued)*

Byte	Value	Bit	Field	Description
16-47	xxh		Password	The password feature is deprecated and will not be supported on future products. This feature is currently only supported on SATA products. If password is not supported, the password and hint length values may be set to 0 or 20h
48-79	xxh		Password Hint	

[a] Byte 4 controls RDX specific-Mode page features. All of the features in this features select byte require media to be inserted. Issuing this Mode Select page with no media inserted in the RDX device will cause the command to fail with CHECK CONDITION status, with the sense key set to NOT READY, and the additional sense code set to MEDIUM NOT PRESENT (02/02/3A00).

PREVENT ALLOW MEDIUM REMOVAL (1Eh)

The Host computer uses the PREVENT ALLOW MEDIUM REMOVAL Command described in SPC-2 to prevent or allow removal of the RDX cartridge. This command works in conjunction with the GET EVENT STATUS NOTIFICATION command (see page 58) to allow RDX button eject.

When medium removal is prevented through PREVENT ALLOW MEDIUM REMOVAL, any eject attempt through START STOP UNIT is denied.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (1Eh)							
01 **…** **03**	Reserved							
04	Reserved						Prevent	
05	Control (not supported)							

Prevent Field

RDX devices support the following Prevent field settings:

- 00b: Media removal is allowed. START STOP UNIT Requests to eject will be allowed. Button requests for eject may be allowed depending on whether GET EVENT STATUS has been sent to the device since power up. See section "GET EVENT STATUS NOTIFICATION (4Ah)" on page 58 for more details.
- 01b: Media removal is prevented. START STOP UNIT and button eject requests will not be allowed.
- Values 10b and 11b are not supported.

RECEIVE DIAGNOSTIC RESULTS (1Ch)

RDX SATA devices accept the RECEIVE DIAGNOSTIC RESULTS command without error, however this command performs no function on the device.

RDX Core reference design uses RECEIVE DIAGNOSTIC RESULTS in conjunction with SEND DIAGNOSTIC RESULTS for page code 0x90 during product interchange testing. Released firmware returns INVALID FIELD IN CDB for all RECEIVE DIAGNISTIC RESULTS page codes.

RELEASE (17h or 57h)

The RDX device accepts the RELEASE (6-byte) and RELEASE (10-byte) command per SPC-2 without error, however this command performs no function on the device.

REPORT LUNS (A0h)

The Host computer uses the REPORT LUNS command to report a LUN inventory of the single LUN device represented by the RDX.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (A0h)							
01 … 05	Reserved							
06	(MSB)							
...	Allocation Length							
09								(LSB)
10	Reserved							
11	Control (not supported)							

Table 2-18 *Report LUNS Return Data*

Byte	Description	Value
08h	LUN List Length	0-3
00h	Reserved	4-7
00h	First LUN	8-15

REQUEST SENSE (03h)

The Host computer uses the REQUEST SENSE command to obtain the current sense data for the device.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (03h)							
01 **…** **03**	Reserved							
04	Allocation Length							
05	Control (not supported)							

Table 2-19 *Request Sense Return Data*

Byte	Description	Value
70h	VALID/Response Code	0
00h	Obsolete	1
xxh	FILEMARK/EOM/ILI/Reserved/SENSE KEY	2
00h	INFORMATION (Not Supported)	3-6
0Eh	ADDITIONAL SENSE LENGTH	7
00h	COMMAND-SPECIFIC INFORMATION (Not Supported)	8-11
xxh[1]	ADDITIONAL SENSE CODE	12
xxh[1]	ADDITIONAL SENSE CODE QUALIFIER	13
00h	FIELD REPLACEABLE UNIT CODE (Not Supported)	14
00h	SKSV/ SENSE-KEY SPECIFIC (Not Supported)	15-17

RESERVE (16h or 56h)

The RDX device accepts the RESERVE (6-byte) and RESERVE (10-byte) command per SPC-2 without error, however this command performs no function on the device.

TEST UNIT READY (00h)

The host uses a TEST UNIT READY command to check the current ready status of the Generic Disk device (including media status).

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (03h)							
01 … 04	Reserved							
05	Control (not supported)							

Note: The Generic Disk device will fail the TEST UNIT READY command with CHECK CONDITION status if RDX media is in any state other than ready.

SEND DIAGNOSTIC (1Dh)

The Host computer uses the SEND DIAGNOSTIC command with the SELFTEST bit set to invoke a self-test on the device.

The SEND DIAGNOSTIC command may also be used to perform other diagnostic related functions using vendor unique diagnostic parameter data.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (1Dh)							
01	Self-Test Code (not supported)			PF (not supported)	Reserved	Self Test[a]	DEVOFFL[b] (not supported)	UNITOFFL[c] (not supported)
02	Reserved							
03	(MSB)			Parameter List Length				(LSB)
04								
05	Control (not supported)							

[a] Refer to "Send Diagnostic Selftest" on page 42

[b] The SATA product supports some additional capabilities with these bits. Refer to Table 2-23 on page 44.

[c] The SATA product supports some additional capabilities with these bits. Refer to Table 2-23 on page 44.

Send Diagnostic Selftest

When the SELFTEST bit is set and DEVOFFL, UNITOFFL bits are cleared a device self-test is performed.

The results of a SELFTEST command will be returned by the SEND DIAGNOSTIC command. The table below shows possible return codes.

When the SEND DIAGNOSTIC SELFTEST command is issued the cartridge and drive LED toggle the same color 3 times.

Table 2-20 *SelfTest Send Diagnostic return codes*

SELFTEST Status	SCSI Status	Sense Key	ASC/ASCQ
Pass	GOOD	NONE	NONE
RDX Dock Error	CHECK CONDITION	See "RDX Dock Selftest Errors" on page 43.	See RDX Dock Selftest Errors
RDX Cartridge Error[a]	CHECK CONDITION	See "RDX Cartridge Selftest Errors" on page 44.	See "RDX Cartridge Selftest Errors" on page 44.
Memory Test Failure[b]	CHECK CONDITION	HARDWARE ERROR (04)	INTERNAL TARGET FAILURE (4400)
Media Diagnostic Failure[c]	CHECK CONDITION	HARDWARE ERROR (04)	HDD DIAGNOSTIC FAILURE (4092)

[a] These tests are only run when an RDX cartridge is inserted in the dock

[b] The RDX performs a simple basic test of memory to ensure integrity.

[c] These tests are only run when an RDX cartridge is inserted in the dock. The ATA command EXECUTE DEVICE DIAGNOSTIC (90h) is issued to the installed RDX cartridge.

Note: The results of SELFTEST may also be obtained through the LOG SENSE command.

RDX Dock Selftest Errors

The errors returned from SELFTEST when an RDX dock is in an error state are shown below. The RDX Dock error status is also noted by an error condition (typically amber LED) on the RDX drive LED.

Table 2-21 *RDX dock error status return codes*

RDX Dock Error Status	SCSI Status	Sense Key	ASC/ASCQ
None	GOOD	NONE	NONE
POST Failed	CHECK CONDITION	HARDWARE ERROR (04)	POST FAILED (4080h)
Eject Failed	CHECK CONDITION	HARDWARE ERROR (04)	EJECT FAILED (4081h)
Firmware Image Corrupt	CHECK CONDITION	HARDWARE ERROR (04)	FIRMWARE IMAGE CORRUPT (4082h)
Other or unknown error condition	CHECK CONDITION	HARDWARE ERROR (04)	INTERNAL TARGET FAILURE (4400h)

RDX Cartridge Selftest Errors

The errors returned from SELFTEST when an RDX cartridge is in an error state are shown below. The RDX Cartridge error status is also noted by an error condition (typically amber LED) on the RDX cartridge LED.

Table 2-22 *RDX Cartridge Error Status return codes*

RDX Cartridge Error Status	SCSI Status	Sense Key	ASC/ASCQ
None	GOOD	NONE	NONE
Inauthentic Cartridge	CHECK CONDITION	HARDWARE ERROR (04h)	CART NOT AUTHENTICATED (4090h)
Incompatible Cartridge	CHECK CONDITION	NOT READY (02h)	INCOMPATIBLE MEDIUM INSTALLED (3000h)
Damaged Cartridge	CHECK CONDITION	HARDWARE ERROR (04h)	CARTRIDGE NOT READY (4091h)
Read Error Occurred Since Cartridge Load	CHECK CONDITION	MEDIUM ERROR (03h)	UNRECOVERED READ ERROR (1100h)
Write Error Occurred Since Cartridge Load	CHECK CONDITION	MEDIUM ERROR (03H)	WRITE ERROR (0C00h)
Cartridge Format Override or Password Protect	CHECK CONDITION	DATA PROTECT (07H)	MEDIUM WRITE PROTECTED (2700h)
Other or unknown error condition	CHECK CONDITION	MEDIUM ERROR (03H)	CARTRIDGE FAULT (5200h)

RDX SATA Send Diagnostic

The RDX SATA supports additional SEND DIAGNOSTIC actions based on the status of DEVOFFL and UNITOFFL bits. These bits are only interrogated when the parameter list length used with SEND DIAGNOSTIC is 0. The following Send Diagnostic actions are taken based on these bit combinations:

Table 2-23 *Send Diagnostic Actions*

SelfTest	DevOffL	UnitOffL	Action
0	0	1	RDX SATA supports transitions to unit offline SCSI status.
0	0	0	RDX SATA supports transitions to unit online SCSI status.
1	0	0	Self test
1	0	1	Results in a reset of the RDX drive.

Send Diagnostic Parameter Data

When a non-zero PARAMETER LIST LENGTH is specified, a vendor-unique Diagnostic page used with the SEND DIAGNOSTIC command. Bits SelfTest, DevOffL and UnitOffl are ignored in this case.

If parameter data is sent for with the SEND DIAGNOSTIC command, it must be in the format specified by the table below.

Table 2-24 *Send Diagnostic Parameter Data*

Byte	Description	Value
See Table 2-25 on page 45	Page Code	0
00h	Page Code Specific	1
n-3	Page Length	2-3
See Page Code Reference Section.	Page specific parameter data	4-n

Table 2-25 *RDX Send Diagnostic page codes*

Page Description	Page Code
RDX Device Diagnostic Tests	80h
Reserved pages[a]	81h-82h
FAN PWM Test[b]	83h
RSOP Program Mode[c]	84h
Eject Configure[d]	85h
Cart Authentication Offload[e]	86h
Reserved pages[f]	86h-8Fh
Interchange test Meta Passthrough[g]	90h

[a] Reserved for debug purposes and future use by Tandberg Data.

[b] Only available in certain manufacturing test builds.

[c] Only available when the RDX device includes an RSOP.

[d] Only available in certain manufacturing test builds.

[e] Tandberg Data proprietary and no longer supported.

[f] Reserved for debug purposes and future use by Tandberg Data.

[g] Used to validate RDX Licensee product through the RDX interchange test. Not supported on released firmware.

RDX Device Diagnostic Tests Page (80h)

The RDX Device Diagnostic Tests page is used to execute diagnostic tests on an RDX device.

Table 2-26 *RDX Device Diagnostic Test page*

Byte	Description	Value
80h	Page Code	0
00h	Page Code Specific	1
0004h	Page Length	2-3
0 = Start LED Test 1 = Stop LED Test 2-FFFFFFFFh = Reserved for future use	Test to run	4-7

A description of each supported test in the RDX Device Diagnostic Tests page is listed below.

LED Test

The LED Test flashes alternating amber and green LED colors on drive and cartridge LED. This test can be used to ensure LED's are functioning properly.

Once the LED test is started with Start LED TEST it remains on continuously until the Stop LED Test diagnostic is executed.

READ BUFFER (3Ch)

The Host computer uses the READ BUFFER command to read data in predefined buffer IDs or to read descriptors describing the contents of specified buffer IDs.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (3Ch)							
01	Reserved				Mode			
02	Buffer ID							
03	(MSB) Buffer Offset							
04								
05								(LSB)
06	(MSB) Allocation Length							
07								
08								(LSB)
09	Control (not supported)							

QuikStation RDX Passthrough Supported Read Buffer Mode Values

The QuikStation RDX Passthrough device supports the following mode fields for each Buffer ID. For more information about the usage of these mode values with specific Buffer IDs please refer to section "Supported Read/Write Buffer IDs" on page 49.

***Table 2-27** Supported Read Buffer mode values*

Value	Description
0010b	Data
0011b	Descriptor
1010b	Echo Buffer (see section "Read/Write Buffer Echo Buffer Support" on page 48)
1011b	Echo Buffer Descriptor

WRITE BUFFER (3Bh)

The host uses the WRITE BUFFER command to write data to volatile memory on the device. The WRITE BUFFER command is also used to download new firmware to the RDX device or cartridge and to program OEM specific parameter information into the device at manufacturing time.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (3Bh)							
01	Reserved				Mode[a b]			
02	Buffer ID[c]							
03	(MSB)			Buffer Offset				
04								
05								(LSB)
06	(MSB)			Parameter List Length				
07								
08								(LSB)
09	Control (not supported)							

[a] All devices support 0010b (Write data) 0110b (download microcode with offsets) and 0111b (download microcode with offsets and save) MODE values for specific write buffer IDs. Please refer to section "Supported Read/Write Buffer IDs" on page 49. All RDX devices also support a mode value of 0x0F for interoperability for RDX Mon.

[b] SATA Devices support 1010b (Echo Buffer) MODE value. Refer to "Read/Write Buffer Echo Buffer Support" on page 48 for more information.

[c] See section "Supported Read/Write Buffer IDs" on page 49.

Read/Write Buffer Echo Buffer Support

The RDX SATA product includes an echo buffer which may be used to read and write data from device volatile memory.

Write Buffer Mode 0x0F

Mode 0x0F is defined by SPC-4 as "Activate Deferred Microcode." This Mode buffer ID was used by the RDXMon eject service to send a timestamp value used in RDX SATA docks. Any check condition on receive of this command is logged in the Windows event log. Therefore all current RDX products support WRITE BUFFER Mode 0x0F as a No-Op command and do not return an error when this command is sent. Also RDX products should not attempt to use the "Download microcode with offsets, save and defer activate mode" described in SPC-4 as timestamp values sent by the RDXMon eject service may be mis-interpreted as "Activate deferred microcode mode."

This command is sent by RDXMon with data length value at byte 8 = 12 and all other bytes equal to 0.

The send of this WRITE BUFFER Mode 0x0f timestamp value through RDXMon was removed with CR 10,718 and RDXMon version 1.50.

The format of the WRITE BUFFER sent by RDXMon to provide a system timestamp is shown in the following table.

***Table 2-28** Write Buffer Mode 0x0F Timestamp*

Byte	Description
0	Reserved
1	
2	
3	
4	MSB
5	Timestamp in milliseconds[a]
6	
7	
8	
9	LSB
10	Reserved
11	

[a] The "Timestamp in milliseconds" value is obtained by multiplying the return value for the POSIX time method by 1000.

Supported Read/Write Buffer IDs

This section describes BUFFER ID values supported by READ/WRITE BUFFER commands.

The following table lists buffer IDs used with READ BUFFER and WRITE BUFFER modes 2 and 3.

***Table 2-29** Modes 2 and 3 Read/Write Buffer IDs*

ID	Name	Description
01h	Assert Error Dump	The RDX SATA product supports an error dump Buffer ID (1) for debug of software assertions. This is a debug feature that may be removed from future released firmware.
02h	Drive Manufacturing Data	Manufacturing Data WRITE BUFFER IDS (2,3,4,10) are used to write manufacturing parameters to a drive.
03h		
04h		
05h	Live Error Dump	The RDX SATA product supports an error dump Buffer ID (5) for debug of drive error states. This is a debug feature that may be removed from future released firmware.

***Table 2-29** Modes 2 and 3 Read/Write Buffer IDs (continued)*

ID	Name	Description
06h	Cartridge Manufacturing Data	Cartridge manufacturing buffer IDs 6,7,8, 9, and 12 are reserved for use with the cartridge manufacturing process.
07h		
08h		
09h		
0Ah	Drive Manufacturing Data	Manufacturing Data WRITE BUFFER IDs (2,3,4,10) are used to write manufacturing parameters to a drive.
0Bh	Cartridge Media Label	The Cartridge Media Label Buffer ID (11) is used to write a media label to the cartridge. This label is returned via the SCSI Inquiry Media Label page (C1h) see section Media Label Page (C1h). This buffer ID is currently only supported by SATA product and may be removed from future releases.
0Ch	Cartridge Manufacturing Data	Cartridge manufacturing buffer IDs 6,7,8, 9, and 12 are reserved for use with the cartridge manufacturing process.
80h	RSOP Serial Data Tx	The RSOP Serial Data Tx BUFFER ID (80h) is used during the programming process for a device containing an RSOP.For more information about using this command to download microcode to an RSOP device, please refer to the Addendum to BIP Users Guide RSOP Download.doc. A READ BUFFER command to this BUFFER ID is not supported.
81h	RSOP Serial Data Rx	The RSOP Serial Data Rx Buffer ID (81h) is used during the programming process for a device containing an RSOP. A WRITE BUFFER command to this Buffer ID is not supported.
82h	Authentication Sector	The Read Write Buffer Authentication Sector Buffer ID (82h) may be used for cartridge authentication purposes. The specifics of this page are Tandberg Data proprietary. RDX Licensees should not read or write this buffer ID.

The following table lists buffer IDs used with READ BUFFER and WRITE BUFFER modes 6 and 7.

***Table 2-30** Modes 6 and 7 Read/Write Buffer IDs*

ID	Name	Description
00h	Device Firmware	The Device Download Microcode WRITE BUFFER ID (0) is used to write device microcode to the RDX. A READ BUFFER command to this BUFFER ID is not supported.
01h	HDD Cartridge Firmware	As an OEM feature, OEM firmware may support download of HDD cartridge firmware. The Download Microcode HDD Cartridge Firmware BUFFER IDs are only available when support for HDD Cartridge firmware download is included in the firmware. When support for this command is included in the firmware build, the device shall return SupportHDDFirmwareFlashing bit = true in standard inquiry DeviceSupportBitmask0. The Download Microcode HDD Cartridge Firmware WRITE BUFFER ID (1) is used to write new firmware to an RDX cartridge. Although it is assumed the RDX Features page will be sent to simulate eject and take the cartridge offline before sending this command, this sequence will not be enforced by the WRITE BUFFER command (see page 47).) On some Operating systems (for example, when a driver has been written specifically for RDX) it may be sufficient to unmount the drive – a simulated eject may not be required.

SEEK (10)

The RDX device accepts the SEEK (10) command per SBC (obsolete in SBC-2) without error, however this command performs no function on the device. This command was implemented for compliance with legacy software applications (reference CR 547, 440.)

FORMAT UNIT (04h)

The RDX device accepts the FORMAT UNIT command per SBC-2 without error, however this command performs no function on the device.

PRE-FETCH (10h)

This command is supported on RDX-SATA products only. The RDX-SATA and RDXCore devices accept the PRE-FETCH command per SBC-2 without error, however this command performs no function on the device.

READ (08h and 28h)

The Host uses the READ command to read a specific LBA on an inserted RDX cartridge.

Read Six-byte CDB

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (08h)							
01	Reserved			(MSB)				
02	Logical Block Address							
03							(LSB)	
04	Transfer Length							
05	Control (not supported))							

Read Ten-byte CDB

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (28h)							
01	RDPROTECT (Not Supported)			DPO (not supported)	FUA (not supported)	Reserved	FUA_NV (not supported)	Obsolete
02	(MSB)							
...	Logical Block Address							
05							(LSB)	
06	Reserved			Group Number (not supported)				
07	(MSB) Transfer Length							
08								(LSB)
09	Control (Not Supported)							

READ CAPACITY (25h)

The Host uses the READ CAPACITY command per SBC-2 to determine the max LBA and the block size of the cartridge inserted into the RDX dock.

This command requires a cartridge in the ready state.

Note: RDX device currently supports only the READ CAPACITY (10) CDB.

Read 10-byte Capacity CDB

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (25h)							
01	Reserved							Obsolete
02	(MSB)							
...	Logical Block Address							
05								(LSB)
06	Reserved							
07								
08	Reserved							PMI (not supported)
09	Control (Not Supported)							

READ CAPACITY (10-byte) Parameter Data

Byte	Description	Value
0-3	Logical Block Address	xxh[a]
4-7	Block Length In Bytes	xxh[b]

[a] The returned LOGICAL Block Address will represent the number of logical blocks (one referenced) available on the inserted RDX cartridge. This will be slightly less than the total blocks available on the disk due to reserved metadata areas used by RDX firmware.

[b] The Block Length in bytes will be 200h for all current RDX firmware. This may change in future releases for cartridges > 2TiB in size.

START STOP UNIT (1Bh)

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (1Bh)							
01	Reserved							IMMED[a] (not supported)
02	Reserved							
03								
04	Power Condition (not supported)				Reserved		LOEJ[b]	START
05	Control (not supported)							

[a] Due to issues with delays in eject the IMMED bit is not honored when set. Status of the eject is never returned immediately by this command.

[b] See Table 2-31 on page 54.

Table 2-31 *LOEJ and START handling*

LOEJ	START	Device State	Action
0	1	Ready	Spin-down the media
1	0	Ready	Spin-up the media
1	0	Ready, Media removal allowed	Start media eject sequence
1	0	Ready, Media removal prevented	Return 02/05/5302 MEDIA REMOVAL PREVENTED
1	1	Not Ready	Start media eject sequence[a]
1	1	Ready	None
0	x	Not Ready	Return 02/02/3A00 MEDIA NOT PRESENT
0	1	Not Ready	Return 02/02/3A00 MEDIA NOT PRESENT

[a] This behavior allows eject of a dead cartridge through an OS eject command. It also means the CAM and eject motor spin when an OS eject is issued and no media is installed in the dock

SYNCHRONIZE CACHE (35h)

The Host may use the SYNCHRONIZE CACHE command to flush all RDX metadata to disk. In addition, a SYNCHRONIZE CACHE command will issue a FLUSH command to the RDX cartridge.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (35h)							
01	Reserved					SYNC_NV (not supported)	IMMED[a] (not supported)	Obsolete
02	(MSB)							
...	Logical Block Address (not supported)[b]							
05							(LSB)	
06	Reserved			Group Number (Not Supported)				
07	(MSB)	Number of Blocks[c] (not supported)						(LSB)
08								
09	Control (not supported)							

[a] This command is always handled as a non-immediate command, even when IMMED is set.

[b] LOGICAL BLOCK ADDRESS field is ignored – the RDX device always flushes metadata and issues a FLUSH command to the RDX cartridge regardless of these values.

[c] Number of Blocks field is ignored – the RDX device always flushes metadata and issues a FLUSH command to the RDX cartridge regardless of these values.

WRITE (0Ah and 2Ah)

The Host uses the WRITE command to write a specific LBA on an inserted RDX cartridge.

This command requires a cartridge in the ready state without write protection.

Write Six-byte CDB

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (0Ah)							
01	Reserved			(MSB)				
02	Logical Block Address							
03							(LSB)	
04	Transfer Length							
05	Control (not supported))							

Write Ten-byte CDB

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (2Ah)							
01	WRPROTECT (Not Supported)			DPO (not supported)	FUA (not supported)	Reserved	FUA_NV (not supported)	Obsolete
02	(MSB)							
...	Logical Block Address							
05							(LSB)	
06	Reserved			Group Number (not supported)				
07	(MSB)			Transfer Length				
08								(LSB)
09	Control (Not Supported)							

Note: All Not Supported fields should be set with 0 values.

WRITE AND VERIFY (2Eh)

The RDX device supports the WRITE AND VERIFY (10-byte) command per SBC-2, however functionally this command behaves exactly the same as the WRITE (10-byte) command (no verification occurs.)

Write and Verify Ten-Byte CDB

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (2Eh)							
01	WRPROTECT (Not Supported)			DPO (not supported)	FUA (not supported)	Reserved	FUA_NV (not supported)	Obsolete
02	(MSB)							
...	Logical Block Address							
05								(LSB)
06	Reserved			Group Number (not supported)				
07	(MSB)			Transfer Length				
08								(LSB)
09	Control (Not Supported)							

VERIFY (2Fh)

The Host computer sends the VERIFY command to the device to request verification of one or more blocks.

Verify Ten-byte CDB

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (2Fh)							
01	VRPROTECT (Not Supported)			DPO (not supported)	Reserved		BYTCHK (not supported)	Obsolete
02	(MSB)							
...	Logical Block Address							
05								(LSB)
06	Reserved			Group Number (not supported)				
07	(MSB)			Verification Length				
08								(LSB)
09	Control (Not Supported)							

GET EVENT STATUS NOTIFICATION (4Ah)

RDX devices use the GET EVENT SATUS NOTIFICATION command (as specified in *MMC-4*) along with a software eject service to support operating system use of the eject button. Eject button support is implemented in Windows as the RDXMon service, included with the RDX host tools package.

The status of the button on the front of the RDX device is reported through the GET EVENT STATUS NOTIFICATION command, as is the current Media Present status and a bit to indicate whether the drive is currently in use for write operations.

GET EVENT STATUS NOTIFICATION is used in conjunction with the PREVENT ALLOW MEDIA REMOVAL command to control RDX eject. When GET EVENT STATUS NOTIFICATION has not been issued to an RDX dock, the eject button functionality is controlled only by the allow removal status of PREVENT ALLOW MEDIA REMOVAL. When the first GET EVENT STATUS NOTIFICATION is received after power-up, however, the eject button is no longer allowed to eject the cartridge based on PREVENT ALLOW MEDIA REMOVAL alone. Host software polling the device with GET EVENT STATUS is then responsible for ejecting the cartridge through START STOP UNIT commands. This implementation protects from eject during disk operations with Windows operating systems previous to Vista SP1 which did not correctly set PREVENT ALLOW MEDIA REMOVAL when accesses to the disk were taking place.

The GET EVENT STATUS NOTIFICATION CDB is defined in *MMC-4* section 6.7.1.1.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (4Ah)							
01	Reserved							Polled[a]
02	Reserved							
03								
04	Notification Class Request[b]							
05	Reserved							
06								
07	(MSB)	Allocation Length (not supported)						(LSB)
08								
09	Control (not supported)							

[a] Polled must be 1. Polled value of 0 is not supported.

[b] NOTIFICATION CLASS REQUEST should be set to 10h (Bit 4) Media event class to request media event status. SATA and RDXCore firmware also supports a setting of 0 to query supported event classes.

Get Event Status Notification Response

As detailed in *MMC-4* section 6.7.2.1, RDX response to GET EVENT STATUS NOTIFICATION includes an event header and event descriptor.

The event header values are returned as specified in *MMC-4*. The Supported Event Classes bitmask will always return 10h – Bit 4 only to signify support for media events only.

Table 2-32 *Event Header Notification Class Request = 0*

Byte	Description	Value
00h	Event Descriptor Length	0-1
80h	NEA/Reserved/Notification Class	2
10h	Supported Event Classes	3

Table 2-33 *Event Header Notification Class Request = 10h*

Byte	Description	Value
00h	Event Descriptor Length	0-1
80h	NEA/Reserved/Notification Class	2
10h	Supported Event Classes	3
See below	Reserved/Event Code	4
See below	Media Status	5
00h	Start Slot	6
00h	End Slot	7

Event Code will be set with one of the following values:

Value	Description
00h NoChg	No Media status to report.
01h Eject Request	An eject has been requested through the RDX front-panel button.

Media Status will be set as follows:

Byte	7	6	5	4	3	2	1	0
0	0						Media Present	0

Media Present will be set whenever media is present and detected in the RDX device. This includes transient states such as media load conditions.

3

Generic Disk

Supported SCSI Commands

The SCSI command information in this chapter references the generic disk.

Table 3-1 lists the Tandberg Data generic disk drive SCSI commands supported by the RDX QuikStation. The RDX Logical Volume iSCSI target is presented to the host as a generic disk.

Table 3-1 *Commands for block devices*

SCSI Command	OP code	Type	Subclause	Go to...
Commands for direct-access block devices				
INQUIRY (6 bytes)	12h	M		page 62
MODE SENSE (6 bytes)	1Ah	O	SPC-2	page 65
PERSISTENT RESERVE IN	5Eh	O[1]	SPC-3 6.11	page 75
PERSISTENT RESERVE OUT	5Fh	O[1]	SPC-3 6.12	page 77
READ - 6 bytes 10 bytes 16 bytes	08h 28h 88h	M M M	5.1.6 5.1.7 5.1.9	page 72
RELEASE (6 bytes)	17h	O[2]	SPC-2	page 70
REPORT LUNS	A0h	O	SPC-2	page 70
REQUEST SENSE (6 bytes)	03h	M	SPC-2	page 71
RESERVE (6 bytes)	16h	O[2]	SPC-2	page 71
START STOP UNIT	1Bh	O	5.1.22	page 74
SYNCHRONIZE CACHE (10 bytes)	35h	O	5.1.23	page 74
TEST UNIT READY (6 bytes)	00h	M	SPC-2	page 72

Table 3-1 *Commands for block devices (continued)*

SCSI Command	OP code	Type	Subclause	Go to...
VERIFY - 10 bytes 16 bytes	2Fh 8Fh	O	5.1.25 5.1.27	page 75
WRITE - 6 bytes 10 bytes 16 bytes	0Ah 2Ah 8Ah	O O O[3]	5.1.28 5.1.29 5.1.31	page 74

INQUIRY (12h)

The Host computer uses the INQUIRY command to retrieve information about the device. Generic Disk supports the Standard INQUIRY Data page (see page 63), in addition to the following Vital Product Data pages listed in Table 3-2 on page 64.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (12h)							
01	Reserved						Obsolete	EVPD
02	Page Code							
03	(MSB) Allocation Length							
04								(LSB)
05	Control (not supported)							

Inquiry CDB Fields

EVPD	Enable Vital Product Data	
	0	Standard inquiry data is returned.
	1	A page of vital product data is returned.
Page Code	If the EVPD bit is set to zero, the Page Code field must be zero. If the EVPD bit is set to 1, the Generic Disk returns the supported vital product data page in this Page Code field:	
	00h	Supported Vital Product Data Pages page
	80h	Unit Serial Number page
	82h	ASCII Implemented Operating Definition page
	83h	Device Identification page
Allocation Length	The maximum amount of data (in bytes) that should be returned.If more than this is available, the amount returned is truncated to the allocation length. No error is reported.	

Standard Inquiry Data Page

When the EVPD bit is 0, the Generic Disk returns Standard Inquiry Data, as described in the following section. Parameters listed with an “x” are unit-specific or vary with the state of the device.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier/Device Type (00h)							
01	Removable Medium (00h)							
02	Version(04h)							
03	0x52							
04	Additional Length (3Bh)							
05 **06** **07**	Reserved (00h)							
8 **...** **15**	Vendor Identification ("TANDBERG")							
16 **...** **31**	Product Identification ("RDX")							
32 **...** **35**	Product Revision Level (x)							
36 **...** **55**	Reserved (00h)							
56	00h							
57	00h							
58	03h							
59	20h							
60	09h							
61	60h							
62	03h							
63	00h							

Supported Vital Product Data Pages (Page Code 00h)

When the EVPD bit is 1 and the Page Code is 00h, the Generic Disk returns the Supported Vital Product Data page as described below. The Supported Vital Product Data Pages page is provided as specified in section 8.4.5 of SPC-2.These pages contain vendor-specific product information.

Table 3-2 *Supported Vital Product Data Pages*

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	Page Code (00h)							
02	Reserved							
03	Page Length							
04	Supported Vital Product Data page (00h)							
05	Unit Serial Number page (80h)							
06	Device Identification page (83h)							

Unit Serial Number Page (80h)

When the EVPD bit is 1 and the Page Code is 80h, the Generic Disk returns the Unit Serial Number page as described below. The Unit Serial Number page is provided as specified in section 8.4.6 of SPC-2.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier (00h)			Peripheral Device Type (00h)				
01	Page Code (80h)							
02	Reserved (00h)							
03	Page Length (10h)							
04 **...** **15**	(MSB) Unit Serial Number (16-byte ASCII) (LSB)							

Device Identification Page (Page Code 83h)

The Device Identification page returns Generic Disk device identifiers, including its product identifier and serial number. Parameters listed with an “x” are unit-specific.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier (00h)				Peripheral Device Type (00h)			
01	Page Code (83h)							
02	Reserved (00h)							
03	Page Length (1Ch)							
04	Code Set (01h)							
05	Identifier Type (first 8 bytes of vendor ID) (01h)							
06	Reserved (00h)							
07	Identifier Length (18h)							
08 ... 15	Vendor Identification (same data reported as Standard Inquiry Vendor ID)							
16 ... 31	Product Identification (same data reported as Standard Inquiry Product ID)							
32 ... 41	Unit Serial Number (xxxxxxxxxx)							
42 ... 49	Space Characters (" ")							

MODE SENSE (1Ah)

The Host computer uses the MODE SENSE command to retrieve specific parameters from the device. Generic Disk supports the 6-byte version of this command.

The formats for the CDB, Mode parameter list, Mode parameter header, Block descriptor, and Mode pages are specified by *SPC-2* and *SBC-2*. The following sections describe the usage for each of these lists.

Mode Sense Six-byte CDB (1Ah)

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code(1Ah)							
01	Reserved				DBD[a]	Reserved		
02	PC[b]		Page Code					
03	Reserved							
04	Allocation Length							
05	Control (not supported)							

[a] If DBD is set, no block descriptions are returned.

[b] Supported Page Control (PC) fields are: 00b=current values, 01b= changeable values, 10b= default values.

Mode Sense Parameter Header — Six-byte

Byte \ Bit	7	6	5	4	3	2	1	0
00	Mode Data Length							
01	Medium Type[a]							
02	Device-Specific Parameter (see Table 3-3 on page 66)							
03	Block Descriptor Length							

[a] Medium Type should be set to 0 on Mode Select commands.

Table 3-3 *Mode Parameter Device-Specific Parameter Field*

	7	6	5	4	3	2	1	0
	WP[a]	Reserved		DPOFUA (not supported)	Reserved			

[a] When returned by MODE SENSE, the WP bit indicates the write protected status of the disk. This bit is ignored in a MODE SELECT command.

Generic Disk Device-Supported Mode Pages

The Generic Disk device accepts the Mode pages listed in the table below.

Table 3-4 *Generic Disk Device-Supported Mode Pages*

Mode Page	Page Code
Disconnect-Reconnect page	02h
Caching Mode page	08h
Control Mode page	0Ah
Informational Exceptions Control page	1Ch
All Pages[a]	3Fh

[a] Refer to SPC-2 for information about the All Pages mode page.

Disconnect-Reconnect Page (02h)

The Disconnect-Reconnect page is described in *SPC-2* section 8.3.7. Generic Disk firmware does not support changeable parameters on this page.

Table 3-5 *Disconnect-Reconnect page data*

Byte	Description	Value
02h	Bit 0-5: PAGE CODE	0
0b	Bit 6: Reserved	
0b	Bit 7: Parameters Savable (PS)	
0Eh	Page Length	1
00h	Buffer Full Ratio	2
00h	Buffer Empty Ratio	3
0000h	Bus inactivity Limit	4-5
0000h	Disconnect Time Limit	6-7
0000h	Connect Time Limit	8-9
0000h	Maximum Burst Size	10-11
00h	EMDP/Fair Arbitration/DIMM/DTDC	12
00h	Reserved	13
00h	First Burst Size	14-15

Caching Mode Page (08h)

The Caching Mode page is described in *SBC-2* section 6.3.3.

An OEM build specific option, WriteCacheCtl, determines how Generic Disk responds to the MODE SELECT COMMAND for the Caching Mode page.

WriteCacheCtl = 0: Generic Disk does not allow the Host computer to change any parameters. In other words, there are no changeable values. Generic Disk ignores any Mode pages sent by the Host computer.

WriteCacheCtl = 1: The only changeable value that the Generic Disk supports is the Writeback Cache Enable bit in the Caching Mode page (08h).

Table 3-6 *Caching Mode page data*

Byte	Description	Value
08h	Bit 0-5: Page Code	0
0b	Bit 6: Reserved	
0b	Bit 7: Parameters Savable (PS)	
12h	Page Length	1
see Table 3-7 on page 68	IC/ABPF/CAP/DISC/SIZE/WCE/MF/RCD	2
00h	Demand Read Retention Priority/Write retention Priority	3
0200h	Disable Pre-Fetch Transfer Length	4-5
0100h	Minimum Pre-Fetch	6-7
0200h	Maximum Pre-Fetch	8-9
0200h	Maximum Pre-Fetch Ceiling	10-11
00h	FSW/LBCSS/DRA/Vendor specific/Reserved/NV_DIS	12
E2h	Number of Cache Segments	13
0000h	Cache segment Size	14-15
00h	Reserved	16
000000h	Obsolete	17-19

Table 3-7 *Caching Mode page WCE Control*

Bit	7	6	5	4	3	2	1	0
	(not supported)					WCE	(Not Supported)	

Control Mode Page (0Ah)

The Control Mode page is described in *SPC-2* section 8.3.6. Generic Disk firmware does not support changeable parameters on this page.

Table 3-8 *Control Mode page data*

Byte	Description	Value
0Ah	Bit 0-5: Page Code	0
0b	Bit 6: Reserved	
0b	Bit 7: Parameters Savable (PS)	
0Ah	Page Length	1
00h	TST/reservd/GLTSD/RLEC	2
00h	QUEUE Algorithm Modifier/reserved/QERR/DQUE	3
00h	TAS/RAC/Reserved/SWP/RAERP/UAAERP/EAERP	4
00h	Reserved/Autoload Mode	5
0000h	Ready AER Holdoff Period	6-7
0000h	Busy Timeout Period	8-9
0000h	Extended Selftest Completion Time	10-11

Informational Exceptions Control Page (1Ch)

The Informational Exceptions Control page is described in *SPC-2* section 8.3.8. Generic Disk firmware does not support changeable parameters on this page.

Table 3-9 *Informational Exceptions Control page data*

Byte	Description	Value
0Ch	Bit 0-5: Page Code	0
0b	Bit 6: Reserved	
0b	Bit 7: Parameters Savable (PS)	
0Ah	Page Length	1
08h	PERF/Reserved/EBF/EWASC/DEXCPT/TEST/Reserved/LOG ERR	2
03h	Reserved/MRIE	3
000000h	Interval Timer	4-7
00000000h	Report Count	8-11

RELEASE (17h)

The Generic Disk device accepts the RELEASE (6-byte) and RELEASE (10-byte) command per SPC-2.

REPORT LUNS (A0h)

The Host computer uses the REPORT LUNS command to report a LUN inventory of the single LUN device represented by the Generic Disk.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (A0h)							
01 **…** **05**	Reserved							
06	(MSB)							
...	Allocation Length							
09								(LSB)
10	Reserved							
11	Control (not supported)							

Table 3-10 *Report LUNS Return Data*

Byte	Description	Value
08h	LUN List Length	0-3
00h	Reserved	4-7
00h	First LUN	8-15

REQUEST SENSE (03h)

The Host computer uses the REQUEST SENSE command to obtain the current sense data for the device.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (03h)							
01 **…** **03**	Reserved							
04	Allocation Length							
05	Control (not supported)							

Table 3-11 *Request Sense Return Data*

Byte	Description	Value
70h	VALID/Response Code	0
00h	Obsolete	1
xxh	FILEMARK/EOM/ILI/Reserved/SENSE KEY	2
00h	INFORMATION (Not Supported)	3-6
0Eh	ADDITIONAL SENSE LENGTH	7
00h	COMMAND-SPECIFIC INFORMATION (Not Supported)	8-11
xxh	ADDITIONAL SENSE CODE	12
xxh	ADDITIONAL SENSE CODE QUALIFIER	13
00h	FIELD REPLACEABLE UNIT CODE (Not Supported)	14
00h	SKSV/ SENSE-KEY SPECIFIC (Not Supported)	15-17

RESERVE (16h)

The Generic Disk device accepts the RESERVE 6-byte command per SPC-2 without error, however this command performs no function on the device.

TEST UNIT READY (00h)

The host uses a TEST UNIT READY command to check the current ready status of the Generic Disk device (including media status).

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (03h)							
01 … 04	Reserved							
05	Control (not supported)							

Note: The Generic Disk device will fail the TEST UNIT READY command with CHECK CONDITION status if RDX media is in any state other than ready.

READ (08h and 28h)

The Host uses the READ command to read a specific LBA on the Generic Disk.

Read Six-byte CDB

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (08h)							
01	Reserved			(MSB)				
02	Logical Block Address							
03							(LSB)	
04	Transfer Length							
05	Control (not supported))							

Read Ten-byte CDB

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (28h)							
01	RDPROTECT (Not Supported)			DPO (not supported)	FUA (not supported)	Reserved	FUA_NV (not supported)	Obsolete
02	(MSB)							
...	Logical Block Address							
05							(LSB)	
06	Reserved			Group Number (not supported)				
07	(MSB)			Transfer Length				
08								(LSB)
09	Control (Not Supported)							

READ CAPACITY (25h)

The Host uses the READ CAPACITY command per SBC-2 to determine the max LBA and the block size of the Generic Disk.

This command requires a disk in the ready state.

Read 10-byte Capacity CDB

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (25h)							
01	Reserved							Obsolete
02	(MSB)							
...	Logical Block Address							
05							(LSB)	
06	Reserved							
07								
08	Reserved							PMI (not supported)
09	Control (Not Supported)							

READ CAPACITY (10-byte) Parameter Data

Byte	Description	Value
0-3	Logical Block Address	xxh[a]
4-7	Block Length In Bytes	xxh

[a] The returned LOGICAL Block Address will represent the number of logical blocks (one referenced) available on the disk.

START STOP UNIT (1Bh)

The Generic Disk supports the Start Stop Unit command without error. However this command performs no function on the device.

SYNCHRONIZE CACHE (35h)

The Host may use the SYNCHRONIZE CACHE command to flush all cached data to disk.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (35h)							
01	Reserved					SYNC_NV (not supported)	IMMED[a] (not supported)	Obsolete
02	(MSB)							
...	Logical Block Address (not supported)[b]							
05							(LSB)	
06	Reserved			Group Number (Not Supported)				
07	(MSB)	Number of Blocks[c] (not supported)						(LSB)
08								
09	Control (not supported)							

[a] This command is always handled as a non-immediate command, even when IMMED is set.

[b] LOGICAL BLOCK ADDRESS field is ignored – the device always flushes metadata and issues a FLUSH command to the disk regardless of these values.

[c] Number of Blocks field is ignored – the device always issues a FLUSH command to the disk regardless of these values.

WRITE (0Ah and 2Ah)

The Host uses the WRITE command to write a specific LBA on the Generic Disk.

This command requires the disk in the ready state without write protection.

Write Six-byte CDB

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (0Ah)							
01	Reserved			(MSB)				
02	Logical Block Address							
03							(LSB)	
04	Transfer Length							
05	Control (not supported))							

Write Ten-byte CDB

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code (2Ah)							
01	WRPROTECT (Not Supported)			DPO (not supported)	FUA (not supported)	Reserved	FUA_NV (not supported)	Obsolete
02	(MSB)							
...	Logical Block Address							
05							(LSB)	
06	Reserved			Group Number (not supported)				
07	(MSB)	Transfer Length						
08								(LSB)
09	Control (Not Supported)							

Note: All Not Supported fields should be set with 0 values.

VERIFY (2Fh)

The Generic Disk supports the Verify command without error; however, this command performs no function on the device.

PERSISTENT RESERVE IN (Eh5)

The PERSISTENT RESERVE IN is used to obtain information about persistent reservations and reservation keys (registrations) active within a device server. This command is used in conjunction with the PERSISTENT RESERVE OUT command.

PERSISTENT RESERVE IN Command (5Eh)

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code(5Eh)							
01	Reserved			Service Action				
02	Reserved							
06								
07	(MSB) Allocation Length							
08								(LSB)
09	Control (not supported)							

Table 3-12 *Supported Persistent Reserve In service action codes*

Code	Name	Description
00h	Read Keys	Reads all registered reservation keys
01h	Read Reservation	Reads the current persistent reservations
02h	Report Capabilties	Returns capability information
03h	Read Full Status	Reads complete information about all registrations and the persistent reservations, if any
04h - 1Fh	Reserved	Reserved

PERSISTENT RESERVE OUT (5Fh)

Byte \ Bit	7	6	5	4	3	2	1	0
00	Operation Code(5Fh)							
01	Reserved			Service Action				
02	Scope				Type			
03	Reserved							
04								
05	(MSB) Allocation Length							
08								(LSB)
09	Control (not supported)							

The Persistent Reserve Out command contains fields that specify a persistent reservation service action, the intended scope of the persistent reservation, and the restrictions caused by the persistent reservation.

Table 3-13 *Supported Persistent Reserve Out service action codes*

Code	Name	Description
00h	Register	Register a reservation key with the device server or unregister a reservation key
01h	Reserve	Creates a persistent reservation having a specified scope and type.
02h	Release	Releases the selected persistent reservation
03h	Clear	Clears all reservation keys (that is, registrations) and all persistent reservations.
04h	Preempt	Preempts persistent reservations and/or removes registrations
05h	Preempt and Abort	Preempt persistent reservations and/or removes registrations and aborts all tasks for all preempted I_T nexuses.
06h	Register and Ignore Existing Key	Register a reservation key with the device server or unregister a reservation key
07h	Register and Move	Register a reservation key for another I_T nexus with the device server and move a persistent reservation to that I_T nexus
08h - 1Fh	Reserved	

Byte \ Bit	7	6	5	4	3	2	1	0
0	(MSB) Reservation Key							
07								(LSB)
08	(MSB) Service Action Reservation Key							
15								(LSB)
16	Obsolete							
19								
20	Reserved				Spec_I_PT	ALL_TG_PT	Reserved	APTPL
21	Reserved							
22	Obsolete							
23								
24	Additional parameter data							
n								

If the Specify Intiator Ports (Spec_I_Pt) bit is set to zero, the device server shall apply the registration only to the I_T nexus that sent the PERSISTENT RESERVE OUT command. If the Spec_I_PT bit is set to one for the REGISTER service action or the REGISTER AND IGNORE EXISTING KEY service action, then the additional parameter data shall include a list of transport IDs and the device server shall also apply the registration to the I_T nexus for each initiator port specified by a TransportID. If a registration fails for any initiator port, none of the other registrations shall be made.

Byte \ Bit	7	6	5	4	3	2	1	0
0	(MSB) Reservation Key							
07								(LSB)
08	(MSB) Service Action Reservation Key							
15								(LSB)
16	Obsolete							
19								
20	Reserved				Spec_I_PT	ALL_TG_PT	Reserved	APTPL
21	Reserved							
22	Obsolete							
23								
24	Additional parameter data							
n								

If the Specify Initiator Ports (Spec_I_PT) bit is set to zero, the device command shall apply the registration only to the I_T nexus that sent the Persistent Reserve Out command. If the Spec_I_PT bit is set to one for the Register service action or the Register and Ignore Existing Key service action, then the additional parameter data shall include a list of transport IDs and the device server shall also apply the registration to the I_T nexus for each initiator port specified by a TransportID. If a registration fails for any initiator port, none of the other registrations shall be made.

The Transporter Parameter Data Length field specifies the number of bytes of TransportIDs that follow.

4

StorageLibrary T24 and StorageLoader

6Supported SCSI Commands

Table 4-1 lists and briefly describes the Tandberg Data Storage Library T24 and Tandberg Data StorageLoader SCSI commands supported by the RDX QuikStation.

Note: The commands issued to the library are independent of the commands issued to the tape drive. For information about the commands for the tape drive, refer to Chapter 5 on page 165.

Table 4-1 *T24 and StorageLoader SCSI command set*

SCSI Command	OP code	Description	Go to...
INITIALIZE ELEMENT STATUS (6 bytes)	07h	Checks all element addresses for cartridges and scans bar code labels.	page 83
INQUIRY (6 bytes)	12h	Sends information about its parameters, including the library serial number, to the initiator.	page 84
LOG SELECT (10 bytes)	4Ch	Manages statistical information maintained by the library.	page 92
LOG SENSE (10 bytes)	4Dh	Returns statistical and condition information to the initiator.	page 94
MODE SELECT (6 bytes)	15h	Accepts specific element addresses, LCD information, and operating parameters from the initiator. Can also prevent access to selected operator panel menus.	page 105
MODE SENSE (6 bytes)	1Ah	Reports its operating mode parameters to the initiator.	page 110
MOVE MEDIUM (12 bytes)	A5h	Moves a cartridge from one location to another.	page 118

Table 4-1 *T24 and StorageLoader SCSI command set (continued)*

SCSI Command	OP code	Description	Go to...
PREVENT/ALLOW MEDIUM REMOVAL (6 bytes)	1Eh	Disables or enables the interlock mechanism in the cartridge access port, preventing or allowing the user from accessing cartridges through the cartridge access port.	page 120
READ ELEMENT STATUS (12 bytes)	B8h	Reports the status of its medium transport, storage, import/export, and data transfer elements to the initiator.	page 122
RELEASE (6 bytes or 10 bytes)	17h 57h	Releases the library from reservations previously set by the initiator using the RESERVE command.	page 136
REQUEST SENSE (6 bytes)	03h	Returns sense data to the initiator.	page 138
REQUEST VOLUME ELEMENT ADDRESS (12 bytes)	B5h	Returns the element descriptors (including element address and status flags for each element) created as a result of the SEND VOLUME TAG command. Data is returned in element address order.	page 144
RESERVE (6 bytes or 10 bytes)	16h 56h	Reserves the library for the initiator's use.	page 157
REZERO UNIT (6 bytes)	01h	Implemented to provide software compatibility when it is required. Because the library does not need to calibrate its mechanics, it always returns and immediate Good status in response to this command.	page 160
SEND VOLUME TAG (12 bytes)	B6h	Compares the template it receives from the initiator to the cartridge inventory information in memory, and determines which bar code labels match the template.	page 160
TEST UNIT READY (6 bytes)	00h	Informs the initiator whether it is ready to accept all other commands.	page 163

INITIALIZE ELEMENT STATUS (07h)

The INITIALIZE ELEMENT STATUS command causes the library to attempt reading any bar code labels that were unreadable during the automatic cartridge inventory. The library checks the elements in ascending element address order. The information obtained by this command can be returned to the initiator using the READ ELEMENT STATUS (B8h) command.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	0	0	1	1	1
01	Reserved							
02	Reserved							
03								
04								
05	NBL	Reserved						

Initialize Element Command Status

The library returns a status byte after processing the INITIALIZE ELEMENT STATUS command as follows:.

Good	The library returns Good status when it is able to process the command without errors.
Busy	Busy status indicates that the library is temporarily unable to accept a command from this initiator. The initiator may retry the command later.
Reservation Conflict	The library returns Reservation Conflict status when it is reserved by a different initiator. See page 157 for more information about the RESERVE command.
Check Condition	Check Condition status is returned for the following reasons: ▸ A Unit Attention condition is pending for the initiator. ▸ The library has experienced an unrecoverable hardware error. ▸ The library encounters a problem while scanning the cartridges. ▸ The library is not ready because a magazine is removed. ▸ A parameter in the CDB is invalid (see Table 4-2 for sense data)

Table 4-2 *Invalid parameters in the INITIALIZE ELEMENT STATUS CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.

INQUIRY (12h)

The INQUIRY command requests that the library send information regarding its parameters to the initiator. The library returns two categories of data in response to this command:

- Standard Inquiry Data (see page 86) contains basic information about the library.
- Vital Product Data (see page 89) contains additional detailed information about the library. Each Vital Product Data page requires a separate INQUIRY command from the initiator.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	1	0	0	1	0
01	Reserved							EVPD
02	Page Code							
03	Reserved							
04	Allocation Length							
05	0	0	Reserved				0	0

Inquiry CDB Fields

EVPD	Enable Vital Product Data. This field indicates the type of inquiry data you are requesting.	
	0	Standard inquiry data (described on page 86
	1	Vital product data (described on page 89), based on the Page Code field (byte 02).
Page Code	This field contains the page number of the vital product data page to be returned for this INQUIRY command.	
	00h	Supported Vital Product Data page
	80h	Unit Serial Number page
	83h	Device Identification page
	C0h	Original Data page
	F0h	Code Level page
Allocation Length	This field specifies the number of bytes that the initiator has allocated for returned inquiry data. A value of 0 indicates that no inquiry data is to be transferred. This condition is not an error.	
	6Ch	(108) bytes for the Standard Inquiry Data
	0Ah	(10) bytes for the Supported Vital Product Data page
	10h	(16) bytes for the Unit Serial Number page
	38h	(56) bytes for the Device Identification page
	6Ch	(108) bytes for the Original Data page
	60h	(96) bytes for the Code Level page
	6Ch	(108) bytes for the Standard Inquiry Data

Note: If the EVPD bit is set to 0, the Page Code must be 00h.

Standard Inquiry Data Page

When the EVPD bit is 0, the library returns 108 bytes of Standard Inquiry Data, as described in the following section.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	RMB	Reserved						
02	Version							
03	AERC	RSVD	Norm ACA	HiSup	Response Data Format			
04	Additional Length							
05	SCCS	Reserved						
06	BQue	EncServ	RSV	MultiP	MChngr	RSVD	RSVD	Addr16
07	RelAdr	RSVD	Wbus16	Sync	Linked	RSVD	Cmd Que	RSVD
08 ... 15	(MSB) Vendor Identification (LSB)							
16 ... 31	(MSB) Product Identification (LSB)							
32 ... 35	(MSB) Product Revision Level (LSB)							
36 ... 54	(MSB) Full Firmware Revision Level (LSB)							
55	Reserved							BarC
56	Reserved				Clocking		QAS	IUS
57	Reserved							
58 ... 73	Version Descriptors							
74 ... 95	Reserved							

Byte \ Bit	7	6	5	4	3	2	1	0
96 ... 107	(MSB) Unit Serial Number (LSB)							

Inquiry Data Fields

Peripheral Qualifier	The value returned for this field is 0, indicating that the media changer is connected to this Logical Unit (LUN 1).
Peripheral Device Type	The value returned for this field is 08h, identifying the library as a medium changer device.
RMB (Removable Medium Bit)	The value returned for this field is 1, indicating that the media is removable.
Version	The value returned for this byte is 04h, indicating support of the current ANSI version of SPC-2 (SCSI Primary Commands – 2).
AERC (Asynchronous Event Reporting Capability)	This field is handled by the tape drive. Refer to Chapter 5 on page 165.
NormACA (Hierarchical Support)	This field is handled by the tape drive. Refer to Chapter 5 on page 165.
HiSup (Normal ACA Supported Bit)	This field is handled by the tape drive. Refer to Chapter 5 on page 165.
Response Data Format	This field is handled by the tape drive. Refer to Chapter 5 on page 165.
Additional Length	The value returned for this field is 67h, indicating that there are 67h (103) additional bytes of inquiry data available to be returned to the initiator.
SCCS (SCC Supported)	This field is handled by the tape drive. Refer to Chapter 5 on page 165.
BQue (Basic Queuing)	This field is handled by the tape drive. Refer to Chapter 5 on page 165.
EncServ (Enclosure Services)	This field is handled by the tape drive. Refer to Chapter 5 on page 165.
MultiP (Multi Port)	This field is handled by the tape drive. Refer to Chapter 5 on page 165.
MChngr (Medium Changer)	This field is handled by the tape drive. Refer to Chapter 5 on page 165.
Addr16 (SCC Supported)	This field is handled by the tape drive. Refer to Chapter 5 on page 165.
RelAdr (Relative Addressing)	This field is handled by the tape drive. Refer to Chapter 5 on page 165.

WBus16 (Wide Bus 16)	This field is handled by the tape drive. Refer to Chapter 5 on page 165.	
Sync (Synchronous Transfer)	This field is handled by the tape drive. Refer to Chapter 5 on page 165.	
Linked (Linked Command)	This field is handled by the tape drive. Refer to Chapter 5 on page 165.	
CmdQue (Command Queuing)	This field is handled by the tape drive. Refer to Chapter 5 on page 165.	
Vendor Identification	The value contained in these bytes is the ASCII representation of “EXABYTE” followed by a single space.	
Product Identification	The value contained in these bytes is the ASCII representation of the identifier, “MAGNUM_224 _ _ _ _ _ _” for T24 and “StorageLoader_ _ _” for the StorageLoader library represents an ASCII space character.	
Firmware Revision Level	The value contained in these bytes is the ASCII representation of the microcode revision level (for example, “C002” or other Tandberg Data microcode revisions) followed by sufficient spaces to fill the field.	
Full Firmware Revision Level	The value contained in these bytes is the ASCII representation of the full microcode revision level, and date (for example, “V1C002 101405”).	
BarC (Bar Code)	The value returned for this field is always 1, indicating that the library has a bar code scanner installed.	
Clocking	This field is handled by the tape drive. Refer to Chapter 5 on page 165.	
QAS (Quick Arbitration Supported)	This field is handled by the tape drive. Refer to Chapter 5 on page 165.	
IUS (Information Units Supported)	This field is handled by the tape drive. Refer to Chapter 5 on page 165.	
Version Descriptors	Each Version Descriptor is a two byte field identifying a standard to which this device claims conformance. There are eight Version Descriptors.	
	0020h	Version Descriptor 1, Conforms to SAM (No version claimed)
	09E0h	Version Descriptor 2, Conforms to SPI-2 (No version claimed)
	0260h	Version Descriptor 3, Conforms to SPC-2 (No version claimed
	02E0h	Version Descriptor 4, Conforms to SMC (No version claimed)
	0000h	Version Descriptors 5 through 8, Not used
Unit Serial Number	The value returned for this field is the serial number for the library. The MSB is contained in byte 96. The library serial number is set at the factory.	

Supported Vital Product Data Page (Page Code 00h)

When the EVPD bit is 1 and the Page Code is 00h, the library returns the Supported Vital Product Data page as described below. These pages contain vendor-specific product information.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	Page Code (00h)							
02	Reserved							
03	Page Length							
04	First Page Code Supported (00h – Supported Vital Product Data page)							
05	Second Page Code Supported (80h – Unit Serial Number page)							
06	Third Page Code Supported (83h – Device Identification page)							
07	Fourth Page Code Supported (C0h – Original Data page)							
08	Fifth Page Code Supported (F0h – Code Level page)							
09	Reserved							

Unit Serial Number Data Page (Page Code 80h)

When the EVPD bit is 1 and the Page Code is 80h, the library returns the Unit Serial Number page as described below.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	Page Code (80h)							
02	Reserved							
03	Page Length (0Ch)							
04 ... 15	(MSB) Unit Serial Number (LSB)							

Device Identification Page (Page Code 83h)

The Device Identification page allows the library to report its device identifiers, including its product identifier and serial number. The library returns the Device Identification page when the EVPD bit in the CDB is 1 and the Page Code is 83h.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier				Peripheral Device Type			
01	Page Code (83h)							
02	Reserved							
03	Page Length							
04	Reserved		Association		Code Set			
05	Reserved				Identifier Type			
06	Reserved							
07	Identifier Length							
08 ... 15	(MSB) Vendor Identification (LSB)							
16 ... 31	(MSB) Product Identification (LSB)							
32 ... 43	(MSB) Unit Serial Number (LSB)							
44	Reserved				Code Set - Node			
45	Reserved		Association - Node		Identifier Type - Node			
46	Reserved							
47	Identifier Length - Node (8h)							
48 ... 55	(MSB) Node Identifier (LSB)							

Original Data Page (Page Code C0h)

The Original Inquiry Data page is a vendor-specific Inquiry Data page. It returns the Standard Inquiry Data for the library as it was originally specified in the microcode. The page is formatted as shown on page 86. All of the Standard Inquiry Data that has been changed using the MODE SELECT (15h) command (86h), or by the tape drive is replaced by the original values.

Code Level Page (Page Code F0h)

The Code Level page is a vendor-specific Inquiry Data page. It provides revision level information about the following:

- The functional code currently stored in the library EEPROM. This code controls the normal operation of the library.
- The boot block code currently stored in the EEPROM. This code allows the functional code to be updated even if the code currently stored in the library is inoperable.
- The self test code currently stored in the EEPROM.
- The Ethernet code currently stored in the EEPROM.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier				Peripheral Device Type			
01	Page Code (F0h)							
02	Reserved							
03	Page Length (5Ch)							
04 **...** **07**	(MSB) Reserved (LSB)							
08 **...** **15**	(MSB) Vendor Identification (LSB)							
16 **...** **31**	(MSB) Product Identification (LSB)							
32 **...** **47**	(MSB) Functional Code Level (LSB)							
48 **...** **63**	(MSB) Boot Block Code Level (LSB)							
64 **...** **79**	Internal Self Test Code Level							
80 **...** **95**	Ethernet Card Code Level							

Inquiry Command Status

The library returns a status byte after processing the INQUIRY command. This section describes when each type of status byte might be returned

Good	The library returns Good status when it is able to process the command without errors.
Busy	The library never returns Busy status for the INQUIRY command.
Reservation Conflict	The library never returns Reservation Conflict status for the INQUIRY command.
Check Condition	The library returns Check Condition status for the following reasons: ▸ A reserved bit is set to 1 in the CDB. ▸ A parameter in the CDB is invalid (see Table 4-3 for sense data)

Table 4-3 *Invalid parameters in the INQUIRY CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	24h	00h	1	1	0	0	0002h	Invalid Page Code.
5h	24h	00h	1	1	1	7	0002h	Page value set but EVPD is 0.

LOG SELECT (4Ch)

The LOG SELECT command allows you to reset the statistical information maintained by the library to zero. The LOG SELECT command does not transfer any parameters to the library and does not include any parameter pages.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	1	0	0	1	1	0	0
01	Reserved						PCR	SP
02 **…** **08**	Reserved							
09	0	0	Reserved				0	0

Log Select CDB Fields

PCR (Parameter Code Reset)	This field specifies whether the library should reset all of the parameters or only selected parameters, as follows:	
	0	Do not reset any parameters
	1	Reset all of the parameters
	Note: If you set the PCR bit to 1, be sure that the Parameter List Length is 0. Otherwise, the library will return Check Condition status with the sense key set to Illegal Request (5h), the ASC and ASCQ set to 24h and 00h.	
SP (Saved Page)	0	The library does not support the saved page function.

Log Select Command Status

The library returns a status byte after processing the LOG SENSE command. This section describes when each type of status byte might be returned.

Good	The library returns Good status when it is able to process the command without errors.
Busy	Busy status indicates that the library is temporarily unable to accept a command from this initiator. The initiator may retry the command later.
Reservation Conflict	The library returns Reservation Conflict status when it is reserved by a different initiator. See page 157 for more information about the RESERVE command.
Check Condition	The command is issued to an invalid LUN. ▸ A Unit Attention condition is pending for the initiator. ▸ A reserved bit is set to 1 in the CDB. ▸ A parameter in the CDB is invalid (see Table 4-4 for sense data).

Table 4-4 *Invalid parameters in the LOG SENSE CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.

LOG SENSE (4Dh)

The LOG SENSE command provides a means for the initiator to retrieve statistics and information on the state of the library. By using this command, you can receive the following information:

- Statistics (for example: retry counts, number of picks and places)
- State of the library hardware
- Element statistics
- Cartridge scan retries
- Element position information
- Last command failure information

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	1	0	0	1	1	0	1
01	Reserved						PPC	SP
02	PC		Page Code					
03	Reserved							
04								
05	(MSB)		Parameter Pointer					(LSB)
06								
07	(MSB)		Allocation Length					(LSB)
08								
09	Reserved							

Log Sense CDB Fields

PPC (Parameter Pointer Control)	0	The value for the PPC field must be 0. This directs the library to return the number of bytes that you specify in the Allocation Length field, beginning with the parameter code specified in the Parameter Pointer field (bytes 05 and 06). The library returns the bytes in ascending order of parameter codes from the specified log page. When both the PPC bit and the Parameter Pointer field are set to 0 and the Allocation Length is sufficient, the library returns all available log parameters for the specified log page to the initiator.
SP (Saved Parameters)	0	The value for this field must be 0, indicating that the library will perform the LOG SENSE command and will not save log parameters.
PC (Page Control)	01h	This field is always ignored and treated as if it contained the value 01h. This indicates that the library will always return the cumulative values for any log parameter requested. The library does not support any threshold values or default cumulative values.
Page Code	The Page Code field allows you to identify the page that you want the library to return. The value for this field must be one of the values specified in Table 4-4; otherwise, the library terminates the command with Check Condition status and sets the sense key to Illegal Request with the ASC set to Invalid Field in CDB.	
Parameter Pointer	The Parameter Pointer field allows you to request parameter data by specifying any of the following types of values. ▸ **A log parameter code.** When you are requesting the Tape Alert page, System Statistics Log page or the Environment page, specify a log parameter code. The library returns the parameter data for that code and all other codes in ascending order until the value specified in the Allocation Length field has been reached or until it completes sending parameter data for the highest code. ▸ **An element address value.** When you are requesting the Element Statistics Log page, or the Scan Retries page, specify an element address value. The library returns the parameter data for that element and all other elements in ascending element address order until the value specified in the Allocation Length field has been reached or until it completes sending parameter data for the element with the highest element address. **Notes:** ▸ When the Parameter Pointer is 0, the library returns all available log parameters for the specified log page (up to the specified Allocation Length). ▸ When the Page Code field is set to 00h, the Parameter Pointer field must also be set to 0, indicating that you are requesting the Supported Log Page (00h), which lists all log pages. ▸ Element addresses may have been changed with the MODE SELECT command.	
Allocation Length	The Allocation Length field allows you to determine the maximum amount of data to be transferred from the library to the initiator. If you specify an allocation length that is greater than the bytes available, the library terminates the Data In phase when all bytes have been transferred. You can specify 0FFFEh to include all available data.	

Log Page Format

This section describes the log page structure and the log pages that the library supports. The LOG SENSE command returns a single log page specified in the Page Code field of the CDB. Each log page begins with a four-byte page header (bytes 00 through 03), followed by zero or more variable-length log parameters defined for that page.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Reserved							
02	(MSB)		Page Length					(LSB)
03								
04 **...** ***n***	Log Parameter (First) **...** Log Parameter (Last)							

Log Page Fields

Page Code	The Page Code field identifies which log page is being transferred. This field contains one of the codes described in Table 4-4.
Page Length	The Page Length field specifies the length, in bytes, of the following Log Parameters. The value returned for this field depends on the value you specified for the Page Code and the Parameter Pointer in the CDB. This value is independent of what you specified for the Allocation Length.
Log Parameters	Log parameters are data structures that are contained in log pages and can be one of the following: Data counters that record a count of a particular event. A numeric value indicating the state of the library hardware. A string that contains the library event history.

Log Parameter Format

Each log parameter begins with a four-byte header followed by one or more bytes of parameter value data.

Byte \ Bit	7	6	5	4	3	2	1	0
00	(MSB)			Parameter Code				(LSB)
01								
02	DU	DS	TSD	ETC	TMC		RSVD	LP
03	Parameter Length							
04	(MSB)			Parameter Value				(LSB)
...								
n								

Log Parameter Fields

Parameter Code	The Parameter Code field identifies which log parameter is being transferred for that log page.	
Parameter Control (DU, DS, TSD, ETC, TMC, LP)	The Parameter Control field consists of the following bits: **DU** – Disable Update This bit indicates that the library updates the log parameter value to reflect all events that should be recorded by that parameter. This bit is always 0. **DS** – Disable Save This bit indicates that the library does not support saving for that log parameter. This bit is always 1. **TSD** - Target Save Disable This bit indicates that the library provides a self-defined method for saving log parameters. This bit is always 0. **ETC** – Enable Threshold Comparison This bit indicates a comparison to the threshold value is not performed whenever the cumulative value is updated. This bit is always 0. **TMC** – Threshold Met Criteria This field defines the basis for comparison of the cumulative and threshold values. This field is always 0. **LP** – List Parameter The List Parameter bit indicates the format of the log parameter:	
	0	The parameter is a data counter.
	1	The parameter is a list parameter.
Parameter Length	The Parameter Length field specifies the length in bytes of the following Parameter Value field (bytes 04 through *n*).	
Parameter Value	The following sections describe all log parameter values that the library supports.	

Supported Log Pages (Page Code 00h)

The Supported Log Pages page lists all log pages that the library supports. The format for this log page is shown below.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Reserved		Page Code (00h)					
01	Reserved							
02	(MSB)		Page Length (7h)					(LSB)
03								
04	Supported Log Page (00h)							
05	Tape Alert Page (2Eh)							
06	System Statistics Page (30h)							
07	Element Status Page (33h)							
08	Scan Retry Page (34h)							
09	Environmental Page (36h)							
10	Command Failure Page (37h)							

Tape Alert Page (Page Code 2Eh)

The TapeAlert page is used for compatibility purposes only and will never report errors.

System Statistics Page (Page Code 30h)

The System Statistics Log page includes four bytes of descriptive information (see page 96) and returns the cumulative library system statistics stored in nonvolatile RAM shown Table 4-5. These values are not reset after power cycles or resets.

Table 4-5 *System Statistics (saved in NVRAM)*

Log Parameter Function	Log Parameter Code	Parameter Control Byte						Parameter Length
		DU	DS	TSD	ETC	TMC	LP	
Total Number of Moves	0	0	1	0	0	0	0	4
Total Number of Pick Retries	1	0	1	0	0	0	0	4
Total Number of Put Retries	2	0	1	0	0	0	0	4
Total Number of Scans	3	0	1	0	0	0	0	4
Total Number of Scan Retries	4	0	1	0	0	0	0	4
Total Number of Scan Failures	5	0	1	0	0	0	0	4

Table 4-5 *System Statistics (saved in NVRAM) (continued)*

Log Parameter Function	Log Parameter Code	Parameter Control Byte						Parameter Length
		DU	DS	TSD	ETC	TMC	LP	
Reserved	6	Reserved						4
Reserved	7	Reserved						2
Reserved	8	Reserved						2
Service Required (bit 0)	9	0	1	0	0	0	0	2
Total Drive Load Retries	10 (0Ah)	0	1	0	0	0	0	4

Element Statistics Page (Page Code 33h)

The Element Statistics page returns cumulative statistics. These values are stored in nonvolatile RAM for each element.

The value that you specify for the Parameter Pointer field of the CDB (bytes 05 and 06) determines the value that the library returns in the Parameter Code field of the Element Statistics page. This value specifies the first element (starting Element Address) for which information is returned.

An Element Statistics page is returned for all subsequent elements (in ascending element address order) until the allocation length specified in the CDB has been reached or all element information has been sent. Element addresses can be changed with the MODE SELECT command.

Note: The Parameter Pointer specified in the CDB indicates the starting element address and must be a valid element address for the library.

Byte \ Bit	7	6	5	4	3	2	1	0
00	(MSB)			Parameter Code (Element Address)				
01								(LSB)
02	0	1	0	0	0	0	0	0
03	Parameter Length (8h)							
04 ... **07**	Total Puts							
08	Total Put Retries							
09								
10	Total Pick Retries							
11								

Cartridge Scan Retries Page (Page Code 34h)

The Cartridge Scan Retries page returns the total number of times the library had to retry scanning the cartridge located in the element. This value is stored in volatile memory for each cartridge and is reset whenever the library is reset, powered-on, or the door is opened. This value can also be cleared by a LOG SELECT command with the Parameter Code Reset bit set.

The value that you specify for the Parameter Pointer field of the CDB (bytes 05 and 06) determines the value that the library returns in the Parameter Code field of the Cartridge Scan Retries page. This value specifies the first element (starting Element Address) for which information is returned.

A Cartridge Scan Retries page is returned for all subsequent elements (in ascending element address order) until the allocation length specified in the CDB has been reached or all element information has been sent. Element addresses can be changed with the MODE SELECT command.

Byte \ Bit	7	6	5	4	3	2	1	0
00	(MSB)			Parameter Code (Element Address)				
01								(LSB)
02	0	1	0	0	0	0	0	0
03	Parameter Length (2h)							
04	Total Scan Retries							
05								

Environmental Page (Page Code 36h)

The Environmental page returns values describing the environment of the library.

Byte \ Bit	7	6	5	4	3	2	1	0
00	(MSB)			Parameter Code				
01								(LSB)
02	0	1	0	0	0	0	0	0
03	Parameter Length (1h)							
04	Parameter Value							

Environmental Page Parameter Values

Table 4-6 lists the environmental parameters returned on the Environmental page.

Table 4-6 *Parameters returned for LOG SENSE Environmental page*

Parameter Code	Value	Description	Bytes
8000h	Current Temperature	Current device temperature (degrees Celsius).	1
8001h	Max Temperature	Maximum device temperature this power on (degrees Celsius).	1
8002h	Lifetime Max Temperature	Maximum device temperature for lifetime of drive (degrees Celsius).	1
8003h	Minimum Temperature	Minimum device temperature this power on (degrees Celsius).	1
8004h	Lifetime Minimum Temperature	Minimum device temperature for lifetime of drive (degrees Celsius).	1
8005h	Power Cycles	Number of time device has been powered on.	4
8004h	Lifetime Minutes Powered On	Number of minutes the device has been powered on.	4

Command Failure Page (Page Code 37h)

The Command Failure page returns values describing the most recently failed motion command that was issued to the library.

Byte \ Bit	7	6	5	4	3	2	1	0
00	(MSB)			Parameter Code				
01								(LSB)
02	0	1	0	0	0	0	0	0
03	Parameter Length (8h)							
04	Command							
05	Fault Symptom Code							
06	Command Interface							
07	Physical Element Address							
08	(MSB)			Total Power On Minutes				
...								
11								(LSB)

Parameter Code Values

The Parameter Code field indicates the which command the information on the Command Failure Code page describes. Table 4-7 lists the valid values for the Parameter Code field.

Table 4-7 *Parameters returned for LOG SENSE Command Failure page*

Parameter Code	Name	Description	Bytes
8000h	Nth Command Failure	Information on last command failure.	8
8001h	N-1 Command failure	Information on next to last command failure.	8
8002h	N-2 Command Failure	Information on second to last command failure.	8
8003h	N-3 Command Failure	Information on third to last command failure.	8

Command Field Values

The Command field indicates name of the failed command. Table 4-8 lists the valid values for the Command field.

Table 4-8 *Codes returned on the LOG SENSE Command Failure page*

Command Code	Name	Description
00h	None	No command
01h	Initialize	Initialize System
02h	Abort	Abort current command
03h	Self Test	Execute Self Test
04h	Update Inventory	Update tape inventory
05h	Position To Element	Position robot to element
06h	Move Medium	Move medium from one element to another
07h	Unlock I/E Port	Unlock I/E port for user access
08h	Unlock Magazine	Unlock Magazine for user access
09h	Clean Drive	Load Cleaning Cartridge, Clean, Unload Cartridge
0Ah	Park Robot	Park Robot for insertion of shipping tab

Fault Symptom Code Values

The Fault Symptom Code field specifies the reason for the most recent Check Condition status. Table 4-9 lists the valid values for the Fault Symptom Code field.

Table 4-9 *Fields returned for LOG SENSE Command Failure page*

Fault Symptom Code	Description
00h	Success (synchronous)
01h	Success (asynchronous)
02h	Service is busy

Table 4-9 *Fields returned for LOG SENSE Command Failure page (continued)*

Fault Symptom Code	Description
03h	Operation stopped
04h	Operation aborted
05h	Software error
06h	System error
07h	General hardware failure
08h	SCSI DMA transfer failed
09h	Servo failure
0Ah	Not implemented
0Bh	System time out
0Ch	General failure
0Dh	Drive time out
0Eh	Servo time out
0Fh	SCSI time out
10h	Command parameter error
11h	SCSI parity error
12h	Device is not ready
13h	Drive is too hot
14h	TapeAlert exception
15h	Microcode for download is bad
16h	A Unit Attention Condition exists
17h	Medium removal disallowed
18h	Drive full
19h	Drive empty
1Ah	Drive command error
1Bh	Drive communication error
1Ch	Cell full
1Dh	Cell empty
1Eh	Drive load failed
1Fh	Drive unload failed
20h	Device Services owned by panel
21h	Device Services owned by E-Net interface
22h	Picker indicates shipping lock in place
23h	Drive interface version not compatible

Table 4-9 *Fields returned for LOG SENSE Command Failure page (continued)*

Fault Symptom Code	Description
24h	Cartridge misloaded
25h	Invalid cartridge type
26h	Servo jammed
27h	Servo unsafe
28h	I/E port unlocked
29h	Magazine unlocked
2Ah	Robot full
2Bh	In sequential mode
2Ch	Cable check failed
2Dh	Robot empty
2Eh	Library overflow (too many cartridges)
2Fh	Mechanical calibration is incomplete

Command Interface Values

The Command Interface field indicates the source of the failed command. Table 4-10 lists the valid values for the Command Interface field.

Table 4-10 *Codes returned for LOG SENSE Command Failure page*

Command Interface Code	Description
00h	None
01h	SCSI Command
02h	Panel Command
03h	Ethernet Command

Log Sense Command Status

The library returns a status byte after processing the LOG SENSE command. This section describes when each type of status byte might be returned.

Good	The library returns Good status when it is able to process the command without errors.
Busy	Busy status indicates that the library is temporarily unable to accept a command from this initiator. The initiator may retry the command later.
Reservation Conflict	The library returns Reservation Conflict status when it is reserved by a different initiator. See page 157 for more information about the RESERVE command.
Check Condition	The library returns Check Condition status for the following reasons: ▸ The command is issued to an invalid LUN. ▸ A Unit Attention condition is pending for the initiator. ▸ A reserved bit is set to 1 in the CDB. ▸ A parameter in the CDB is invalid (see Table 4-4 for sense data).

Table 4-11 *Invalid parameters in the LOG SENSE CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	24h	00h	1	1	1	0	0000h	The SP field is incorrect. It must be set to 00b.
5h	24h	00h	1	1	1	1	0001h	The PPC field is incorrect. It must be set to 00b.
5h	24h	00h	1	1	1	7	0002h	The PC field is incorrect. It must be set to 01b.
5h	24h	00h	1	1	1	5	0002h	Invalid Page Code.
5h	24h	0h	1	1	0	0	0005h	Invalid parameter pointer.

MODE SELECT (15h)

The MODE SELECT command allows you to specify operating parameters for the library. These parameters configure the library upon power-up or a reset condition. You provide the parameters in a parameter list that can include the following:

- 4 bytes for the Parameter List Header (required)
- 20 bytes for the Element Address Assignment page
- 6 bytes for the Unique Properties page
- 36 bytes for the LCD Mode page
- 4 bytes for the Cleaning Configuration page (not used)

Important The values sent to the library apply to all initiators in a multi-initiator environment. If an initiator issues a MODE SELECT command that changes any current or saved operating parameters, the library returns a Check Condition status with a sense key of Unit Attention (6h) and an ASC and ASCQ of Mode Parameters Changed (2Ah and 01h, respectively) to all other initiators that issue a request to the library.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	0	1
01	Reserved			PF	Reserved			SP
02	Reserved							
03								
04	Parameter List Length							
05	0	0	Reserved				0	0

Mode Select CDB Fields

PF (Page Format)	1	The library supports the page format specified by SPC-2. This value must be 1.
SP (Saved Page)	0	Current configuration values are changed to the values sent to the library. Saved values stored in nonvolatile memory are not affected.
	1	Current configuration values specified by this command are saved in nonvolatile memory and are used for subsequent operations.
Parameter List Length	This field indicates the length of the entire parameter list. The parameter list length is equal to the length of one Parameter List Header (4 bytes) plus the lengths of all pages to be transferred. Table 4-12 lists the page lengths. If no pages are to be transferred, specify 0 for the Parameter List Length field. **Note:** A parameter list length of 4 is not valid. When you send the Parameter List Header, you must send at least one page with it.	

Table 4-12 *MODE SELECT page lengths*

Page	Length (bytes)
Element Address Assignment Page	14h (20)
Unique Properties Page	6h (6)
LCD Mode Page	24h (36)
Cleaning Configuration Page (not used)	4h (4)

Parameter List Header

If you send one or more parameter pages with the MODE SELECT command, you must send a Parameter List Header. Do not send the Parameter List Header if you are not sending any parameter pages.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Reserved							
01								
02								
03								

All fields of the Parameter List Header are reserved. You must specify a value of 0 for each field.

Element Address Assignment Page (Page Code 1Dh)

This section describes the fields for the Element Address Assignment page and the values you can specify for these fields.

Important For the starting element addresses, you can specify any 16-bit binary number, with the following conditions:

- Element addresses must not overlap.
- Addresses within each type of element must be consecutive. The highest address you can assign for the first storage element is: **T24**–FFE8h (1111111111101000b). This causes the last storage element to be numbered 0FFFFh (1111111111111111b) **StorageLoader 2U**–FFECh (1111111111101100b). This causes the last storage element to be numbered 0FFFFh (1111111111111111b)

Byte \ Bit	7	6	5	4	3	2	1	0
00	Reserved		Page Code (1Dh)					
01	Page Length (12h)							
02	(MSB) Medium Transport Element Address (61h)							
03								(LSB)
04	(MSB) Number of Medium Transport Elements (1)							
05								(LSB)
06	(MSB) First Storage Element Address (01h)							
07								(LSB)
08	(MSB) Number of Storage Elements (8 for T24) (14h for StorageLoader)							
09								(LSB)
10	(MSB) First Import/Export Element Address (71h)							
11								(LSB)
12	(MSB) Number of Import/Export Elements (1)							
13								(LSB)
14	(MSB) First Data Transfer Element Address (51h)							
15								(LSB)
16	(MSB) Number of Data Transfer Elements (1 or 2)							
17								(LSB)
18	Reserved							
19								

Mode Select Command Status

The library returns a status byte after processing the MODE SELECT command. This section describes when each type of status byte might be returned.

Good	The library returns Good status when it is able to process the command without errors (that is, when the requested MODE SELECT parameters have been copied over the current MODE SELECT settings and, if requested, the saved MODE SELECT settings).
Busy	Busy status indicates that the library is temporarily unable to accept a command from this initiator. The initiator may retry the command later.
Reservation Conflict	The library returns Reservation Conflict status when it is reserved by a different initiator. See page 157 for more information about the RESERVE command.
Check Condition	The library returns Check Condition status for the following reasons: ▸ The command is issued to an invalid LUN. ▸ A Unit Attention condition is pending for the initiator. ▸ A reserved bit is set to 1 in the CDB. ▸ The library detects an unrecoverable parity error while receiving the MODE SELECT data. ▸ A parameter in the CDB on a MODE SELECT page is invalid (see Table 4-13 for sense data).

Table 4-13 *Invalid parameters in the MODE SELECT CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	1Ah	00h	1	1	0	0	0004h	Invalid Parameter List Length.
5h	21h	01h	1	0	0	0	[a]	Address overlap. The field pointer is set to the value representing the field in the Element Address Assignment page which caused the address overlap, as follows: ▸ 0006h – Medium Transport Element Address ▸ 000Ah – Storage Element Address
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	24h	00h	1	1	1	4h	0001h	Invalid PF (page format). Must be 1.

Table 4-13 *Invalid parameters in the MODE SELECT CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	26h	00h	1	0	0	0	[a]	Invalid values in the Parameter List Header. All values must be 0. The value of the field pointer is the value of the first field that contains a non-zero value (00, 01, 02, or 03).
5h	26h	00h	1	0	1	5h	[a]	Invalid Page Code.
5h	26h	00h	1	0	1	7h	[a]	Reserved bits set in the first byte of one of the MODE SELECT pages.
5h	26h	00h	1	0	0	0	[a]	Invalid Parameter Length.
5h	26h	00h	1	0	0	0	[a]	Reserved bits set in the reserved fields 22 or 23 (bytes 18 or 19 of the Element Address Assignment page).
5h	26h	00h	1	0	0	0	[a]	Invalid first import/export address.
5h	26h	00h	1	0	0	0	[a]	Storage element addresses are not consecutive.
5h	26h	00h	1	0	0	0	[a]	Data transfer element addresses are not consecutive.
5h	26h	02h	1	0	0	0	[a]	Address wrap. Number of elements causes the address range to wrap back to 0000.
5h	26h	02h	1	0	0	0	[a]	Invalid number of transport elements.
5h	26h	02h	1	0	0	0	[a]	Invalid number of storage elements.
5h	26h	02h	1	0	0	0	[a]	Invalid number of import/export elements.
5h	26h	02h	1	0	0	0	[a]	Invalid number of data transfer elements.

[a] Field pointer depends on the order in which the pages are sent.

MODE SENSE (1Ah)

The MODE SENSE command enables the library to report its operating mode parameters to the initiator. The initiator can request one or all pages of mode parameters. Each response includes four bytes for the Parameter List Header, followed by the specified number of bytes for each page:

- 20 bytes for the Element Address Assignment page
- 4 bytes for the Transport Geometry Descriptor page
- 20 bytes for the Device Capabilities page
- 6 bytes for the Unique Properties page

Using the MODE SELECT (15h) command, you can change the values of all of these parameters, except the Transport Geometry Descriptor page and the Device Capabilities page.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	1	1	0	1	0
01	Reserved				DBD	Reserved		
02	PC		Page Code					
03	Reserved							
04	Allocation Length							
05	Reserved							

Mode Sense CDB Fields

DBD (Disable Block Descriptors)	The library ignores this bit.	
PC (Page Control)	This field defines the type of parameters that are to be returned for the MODE SENSE command. Specify one of the following values:	
	0 (00b)	Indicates that the library should return the current parameter values. The current values returned are: ▸ The parameters set in the last successful MODE SELECT command. ▸ The saved values, if a MODE SELECT command has not been executed since the last power-on or reset. ▸ The default values, if saved values are not available.
	1 (01b)	Indicates that the library should return the changeable parameter masks. The pages you request are returned and indicate which parameters you can change. All bits of parameters that you can change are set to 1. All bits of parameters that you cannot change are set to 0. The Page Code and Parameter List Length fields contain actual values.
	2 (10b)	Indicates that the library should return the default values. The pages you request are returned, with each supported parameter set to its default value. Parameters not supported by the library are set to 0.
	3 (11b)	Indicates that the library should return the saved values. The pages you request are returned, with each supported parameter set to its saved value. Parameters not supported by the library are set to 0.

Page Code	This field allows you to specify which page the library should return. Specify one of the following values:	
	1Dh	Element Address Assignment page
	1Eh	Transport Geometry Descriptor page
	1Fh	Device Capabilities page
	21h	Unique Properties page
	22h	LCD Mode page
	25h	Cleaning Configuration Page
	26h	Operating Mode Page
Allocation Length	This field allows you to specify the length of the parameter list the library will return. The maximum length you need to specify to receive all pages is 98 (62h) bytes. The library terminates the data in phase when the number of bytes specified by the Allocation Length have been transferred or when all available MODE SENSE data have been transferred to the initiator, whichever is less.	

Parameter List Header Format

Each mode data page begins with a four-byte parameter list header, followed by zero or more variable-length mode data parameters defined for the specified page.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Mode Data Length							
01	Reserved							
02								
03								

Element Address Assignment Page (Page Code 1Dh)

Byte \ Bit	7	6	5	4	3	2	1	0
00	PS (1)	RSVD	Page Code (1Dh)					
01	Parameter Length (12h)							
02	(MSB) Medium Transport Element Address							
03	(LSB)							
04	(MSB) Number of Medium Transport Elements							
05	(LSB)							
06	(MSB) First Storage Element Address							
07	(LSB)							
08	(MSB) Number of Storage Elements							
09	(LSB)							
10	(MSB) First Import/Export Element Address							
11	(LSB)							
12	(MSB) Number of Import/Export Elements							
13	(LSB)							
14	(MSB) First Data Transfer Element Address							
15	(LSB)							
16	(MSB) Number of Data Transfer Elements							
17	(LSB)							
18	Reserved							
19								

Element Address Assignment Fields

PS (Page Savable)	1	The value returned for this field is 1, which indicates that the library can save this page to nonvolatile memory.
Page Code	1Dh	This field identifies the Element Address Assignment page.
Parameter Length	12h	The value returned (12h) indicates that there are an additional 18 bytes of element address data that follow this byte.
Medium Transport Element Address	61h	This field identifies the address of the cartridge loader.
Number of Medium Transport Elements	1	This field identifies the number of cartridge loaders within the library. The library has only one cartridge loader.
First Storage Element Address	01h	This field identifies the starting address of the cartridge storage locations. The default starting address is 01h (1). You can change this address with the MODE SELECT (15h) command.
Number of Storage Elements	This field identifies the maximum number of cartridge storage locations within the library.	
	18h	StorageLibrary T24
	14h	StorageLoader 2U
First Import/Export Element Address	71h	This field identifies the address of the entry/exit port. The library has one I/E port. If the I/E port element is enabled, the default starting address for the I/E port element is 71h.
First Data Transfer Element Address	51h	This field identifies the starting address of the installed tape drives.
Number of Data Transfer Elements	This field identifies the number of tape drives in the library.	
	1	StorageLoader has one tape drive.
	2	StorageLibrary T24 has 2 tape drives.

Transport Geometry Descriptor Page (Page Code 1Eh)

Byte \ Bit	7	6	5	4	3	2	1	0
00	PS (0)	RSVD	Page Code (1Eh)					
01	Parameter Length (02h)							
02	Reserved							Rotate (0)
03	Member Number in Transport Element Set (0)							

Device Capabilities Page (Page Code 1Fh)

Byte \ Bit	7	6	5	4	3	2	1	0
00	PS (0)	RSVD	Page Code (1Fh)					
01	Parameter Length (12h)							
02	Reserved				DT 1	I/E 1	ST 1	MT 0
03	Reserved							
04	Reserved				MT→DT 0	MT→I/E 0	MT→ST 0	MT→MT 0
05	Reserved				ST→DT 1	ST→I/E 1	ST→ST 1	ST→MT 0
06	Reserved				I/E→DT 1	I/E→I/E 1	I/E→ST 1	I/E→MT 0
07	Reserved				DT→DT 1	DT→I/E 1	DT→ST 1	DT→MT 0
08 **...** **19**	Reserved							

Device Capabilities Page Fields

DT (Data Transfer Element)	1	The value returned for this field indicates that the tape drive can store cartridges. (A cartridge in a tape drive, either loaded or ejected, is considered "stored" in the tape drive.)
I/E (Import/Export Element)	1	The value returned for this field indicates whether the library has an entry/exit port that can store a data cartridge. The library does have an entry/exit port.
ST (Storage Element)	1	The value returned for this field indicates that the cartridge storage locations can store cartridges.
MT (Media Transport)	0	The value returned for this field indicates that the cartridge loader cannot store cartridges.
MT → DT	1	The value returned for this field indicates that the library does not support the MOVE MEDIUM (A5h) command when the source is the cartridge loader and the destination is the tape drive.
MT → I/E	0	The value returned for this field is 0, which indicates that the library does not support the MOVE MEDIUM (A5h) command when the source is the cartridge loader and the destination is the entry/exit port element.
MT → ST	0	The value returned for this field is 0, which indicates that the library does not support the MOVE MEDIUM (A5h) command when the source is the cartridge loader and the destination is a cartridge storage location.

MT → MT	0	The value returned for this field indicates that the library does not support the MOVE MEDIUM (A5h) command when the source is the cartridge loader and the destination is the cartridge loader.
ST → DT	1	The value returned for this field indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a cartridge storage location and the destination is a tape drive.
ST → I/E	1	The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a cartridge storage location and the destination is the import/export element.
ST → ST	1	The value returned for this field indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a cartridge storage location and the destination is a cartridge storage location.
ST → MT	0	The value returned for this field indicates that the library does not support the MOVE MEDIUM (A5h) command when the source is a cartridge storage location and the destination is the cartridge loader.
I/E → DT	1	The value returned for this field indicates that the library supports the MOVE MEDIUM (A5h) command when the source is the import/export element and the destination is a tape drive.
I/E → I/E	1	The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is the import/export element and the destination is the import/export element.
I/E → MT	0	The value returned for this field indicates that the library does not support the MOVE MEDIUM (A5h) command when the source is the import/export element and the destination is the cartridge loader.
DT → DT	1	The value returned for this field indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is a tape drive.
DT → I/E	1	The value returned for this field indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is the import/export element.
DT → ST	1	The value returned for this field indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is a cartridge storage location.
DT → MT	0	The value returned for this field indicates that the library does not support the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is the cartridge loader.

Unique Properties Page (Page Code 21h)

The Unique Properties Page provides information about the options for the library that are unique to the library.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Reserved		Page Code (21h)					
01	Page Length (4h)							
02	(MSB)		Reserved					(LSB)
03								
04	MaxStor[a]	Reserved	MaxStorAddr[b]					
05	Reserved	DisIEP	DislEP2	Reserved		Dead	Reserved	

[a] MaxStor field will always return 0. For compatibility purposes only.

[b] MaxStorAddr field will always return 0. For compatibility purposes only.

Mode Sense Command Status

The library returns a status byte after processing the MODE SENSE command. This section describes when each type of status byte might be returned.

Good	The library returns Good status when it is able to process the command without errors.
Busy	Busy status indicates that the library is temporarily unable to accept a command from this initiator. The initiator may retry the command later.
Reservation Conflict	The library returns Reservation Conflict status when the library is reserved by a different initiator. See page 157 for more information about the RESERVE command.
Check Condition	The library returns Check Condition status for the following reasons: ▸ The command is issued to an invalid LUN. ▸ A Unit Attention condition is pending for the initiator. ▸ A reserved bit is set to 1 in the CDB. ▸ A parameter in the CDB is invalid (see Table 4-14 for sense data).

Table 4-14 *Invalid parameters in the MODE SENSE CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	24h	00	1	1	1	3h	0001h	Invalid value in DBD field. Must be 1.
5h	24h	00	1	1	1	5h	0002h	Invalid Page Code.

MOVE MEDIUM (A5h)

The MOVE MEDIUM command requests that the cartridge loader move a cartridge from a source element location (address) to a destination element location (address). If the destination is a tape drive, the library will insert the cartridge.

Byte \ Bit	7	6	5	4	3	2	1	0
00	1	0	1	0	0	1	0	1
01	Reserved							
02	(MSB) Transport Element Address							
03	(LSB)							
04	(MSB) Source Address							
05	(LSB)							
06	(MSB) Destination Address							
07	(LSB)							
08	Reserved							
09								
10	Reserved							Invert
11	Reserved							

Move Medium CDB Fields

Transport Element Address	This field is checked for the value set by the MODE SELECT (15h) command. It should contain 0 or the element address of the cartridge loader.	
Source Address	This field specifies the element address from which the cartridge is to be taken. This can be a storage location, a tape drive, or the I/E port element.	
Destination Address	This field specifies the element address where the cartridge is to be placed. This can be a storage location, a tape drive, or the I/E port element.	
Invert	0	The library does not support the Invert function.

Move Medium Command Status

The library returns a status byte after processing the MOVE MEDIUM command

Good	The library returns Good status when it is able to process the command without errors.
Busy	Busy status indicates that the library is temporarily unable to accept a command from this initiator. The initiator may retry the command later.
Reservation Conflict	The library returns Reservation Conflict status when the library is reserved by a different initiator. See page 157 for more information about the RESERVE command.
Check Condition	The library returns Check Condition status for the following reasons: ▸ The library returns Check Condition status for the following reasons: ▸ The command is issued to an invalid LUN. ▸ A Unit Attention condition is pending for the initiator. ▸ The library has experienced an unrecoverable hardware error. ▸ A reserved bit is set to 1 in the CDB. ▸ The library is not ready because a magazine is removed. ▸ The information in the cartridge inventory indicates that the requested cartridge move operation cannot be performed. ▸ After the library attempts to move a cartridge, it finds that the source is empty or the destination is occupied. ▸ The library encounters a problem while trying to move a cartridge. For example, it encounters a place (put) error while moving a cartridge. ▸ A parameter in the CDB is invalid (see Table 4-15 for sense data).

Table 4-15 *Invalid parameters in the MOVE MEDIUM CDBs*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
3h	53h	00h	0	0	0	0	0	Media load or eject failed.
5h	21h	01h	1	1	0	0	0002h	Invalid transport element address.
5h	21h	01h	1	1	0	0	0004h	Invalid source element address.
5h	21h	01h	1	1	0	0	0006h	Invalid destination element address.
5h	24h	00	1	1	1	0	000Ah	Invalid Invert field.
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.

Table 4-15 *Invalid parameters in the MOVE MEDIUM CDBs*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	3Bh	0Dh	0	0	0	0	0	Destination element occupied.
5h	3Bh	0Eh	0	0	0	0	0	Source element empty.
5h	3Bh	87h	0	0	0	0	0	Cartridge stuck in tape drive.
5h	3Bh	90h	0	0	0	0	0	Source cartridge is loaded inside the tape drive and is not accessible.
5h	80h	05h	0	0	0	0	0	Source tape drive not installed.
5h	80h	06h	0	0	0	0	0	Destination tape drive not installed.

PREVENT/ALLOW MEDIUM REMOVAL (1Eh)

The PREVENT/ALLOW MEDIUM REMOVAL command requests that the library enable or disable access to the cartridge storage area. If at least one initiator has issued this command to prevent cartridge removal, then the I/E Port(s) and magazines cannot be opened from the operator panel.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	1	1	1	1	0
01	Reserved							
02	Reserved							
03								
04	Reserved							Prevent
05	Reserved							

Prevent/Allow Medium Removal CDB Fields

Prevent	The valid values for this field are as follows:	
	00b	Allow removal of cartridges through the cartridge access port door.
	01b	Prevent removal of cartridges through the cartridge access port door.
	10b	Invalid.
	11b	Invalid.
	When the Prevent bit is set to 01b, an interlock mechanism on the cartridge access port door activates to prevent the door from being opened until one of the following occurs: All initiators that have issued PREVENT MEDIUM REMOVAL commands issue ALLOW MEDIUM REMOVAL commands with the Prevent bit set to 0. The library is reset.	

Prevent/Allow Command Status

The library returns a status byte after processing the PREVENT/ALLOW MEDIUM REMOVAL command. This section describes when each type of status byte might be returned.

Good	The library returns Good status when it is able to process the command without errors.
Busy	Busy status indicates that the library is temporarily unable to accept a command from this initiator. The initiator may retry the command later.
Reservation Conflict	The library returns Reservation Conflict status when it is reserved by a different initiator and a request is made to prevent medium removal. See page 157 for more information about the RESERVE command.
Check Condition	The library returns Check Condition status when: ▸ The command is issued to an invalid LUN. ▸ A Unit Attention condition is pending for the initiator. ▸ A reserved bit is set to 1 in the CDB.

Table 4-16 *Invalid parameters for PREVENT/ALLOW MEDIUM REMOVAL*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.

READ ELEMENT STATUS (B8h)

The READ ELEMENT STATUS command requests that the library return the status of its elements. This command returns the data created as a result of the INITIALIZE ELEMENT STATUS (07h).

Byte \ Bit	7	6	5	4	3	2	1	0
00	1	0	1	1	1	0	0	0
01	Reserved			VolTag	Element Type Code			
02	(MSB) Starting Element Address							
03	(LSB)							
04	(MSB) Number of Elements							
05	(LSB)							
06	Reserved						CurData	DVCID
07	(MSB) Allocation Length							
08								
09	(LSB)							
10	Reserved							
11	S/N Req (Obsolete)	Reserved					0	0

Read Element Status CDB Fields

VolTag	This bit indicates whether you want the library to return volume tag (bar code label) information in response to this command, as follows:	
	0	Do not return volume tag (bar code label) information.
	1	Return volume tag (bar code label) information.
Element Type Code	This field specifies the particular element types you want the library to report on. The library supports the following Element Type Codes:	
	0h	All element types.
	1h	Medium Transport Element (cartridge loader).
	2h	Storage Element (cartridge cells).
	3h	I/E Port Element (cartridge access port).
	4h	Data Transfer Element (tape drives).
	For an Element Type Code of 0h, the element types are reported in element address order, beginning with the Starting Element Address.	

Starting Element Address	This field indicates the element address at which to start the transfer of data. Only elements with addresses greater than or equal to the starting address are reported. Element descriptor blocks are not generated for undefined element addresses.	
Number of Elements	This field specifies the maximum number of element descriptors to be returned. This is an actual number of element descriptors to be returned, not an element address range. The library returns element descriptors of the requested element type starting with the first element address equal to or greater than the value in the Starting Element Address field.	
CURDATA	The CURDATA (current data) bit determines whether the library allows device motion in order to update element status, as follows:	
	0	May use motion to confirm device status.
	1	May not use motion; must use currently available data.
DVCID	The DVCID (device ID) bit indicates whether the library appends the device identifier for the tape drive, if available, to the standard data transfer element descriptor, as follows:	
	0	Do not append the device identifier.
	1	Append the device identifier.
Allocation Length	This field specifies the length in bytes of the space that you are allocating for returned element descriptors. Only complete element descriptors are returned. The library returns element descriptors until *one* of the following conditions is met: ▸ All available element descriptors have been returned. ▸ The number of element descriptors specified in the Number of Elements field has been returned. ▸ The remaining allocation length is smaller than the next complete element descriptor or header to be returned.	
S/N Request	This field is obsolete and only retained for compatibility. The DVCID field should be used to match drives to libraries. This bit indicates whether the library appends the ten-byte tape drive serial number to the standard data transfer element descriptor, as follows:	
	0	Do not append the tape drive serial number.
	1	Append the tape drive serial number.

Element Status Header

The Element Status page begins with an eight-byte Element Status Header, followed the requested element descriptors.

This header is returned once for each READ ELEMENT STATUS command received by the library.

Byte \ Bit	7	6	5	4	3	2	1	0
00	(MSB) First Element Address Reported							
01								(LSB)
02	(MSB) Number of Elements Reported							
03								(LSB)
04	Reserved							
05	(MSB) Byte Count of Report Available							
06								
07								(LSB)

Element Status Page

The library returns one Element Status page for each group of element descriptors of the same type (that is, it returns one page for each of the following: cartridge loader, cartridge storage locations, I/E ports, and tape drives). The Element Status page is returned only if there is at least one Element Descriptor also being returned.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Element Type Code							
01	PVolTag	AVolTag	Reserved					
02	(MSB) Element Descriptor Length							
03								(LSB)
04	Reserved							
05	(MSB) Byte Count of Descriptor Data Available							
06								
07								(LSB)

Element Status Page Fields

<table>
<tr><td>Element Type Code</td><td colspan="4">This field indicates the specific element type (see page 122) being reported by the element descriptor.</td></tr>
<tr><td rowspan="3">PVolTag</td><td colspan="4">This field indicates if primary volume tag (bar code label) information is present, as follows:</td></tr>
<tr><td>0</td><td colspan="3">Volume tag bytes are omitted from the element descriptors.</td></tr>
<tr><td>1</td><td colspan="3">Volume tag information is present.</td></tr>
<tr><td>AVolTag</td><td>0</td><td colspan="3">The library does not support alternate volume tags.</td></tr>
<tr><td>Element Descriptor Length</td><td colspan="4">This field indicates the total number of bytes contained in a single element descriptor, as follows:
If the descriptor being returned is for either the medium transport element (the cartridge loader) or a storage element (cartridge cell), the length is either 52 bytes (if the VolTag bit is 1) or 16 bytes (if the VolTag bit is 0).
If the descriptor being returned is for a data transfer element (a tape drive), the element descriptor length changes depending on the setting of the DVCID, VolTag, and S/N Req bits, as follows:
<table>
<tr><th>DVCID</th><th>VolTag</th><th>S/N Req</th><th>Element Descriptor Length (bytes)</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>16</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>26</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>52</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>62</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>62</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>72</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>98</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>108</td></tr>
</table></td></tr>
<tr><td>Byte Count of Descriptor Data Available</td><td colspan="4">This field indicates the total number of bytes of element descriptor data available for the elements of this element type that meet the CDB requirements. This value is the Element Descriptor Length multiplied by the number of element descriptors. This value is not adjusted to match the value that you specified in the Allocation Length field of the CDB.</td></tr>
</table>

Element Descriptors

The following sections contain the field definitions for the four types of element descriptors for the library:

- **Medium transport element**: The cartridge loader
- **Storage elements**: The cartridge cells
- **I/E port element(s)**: The cartridge access port
- **Data transfer element**: The tape drive

Each element descriptor includes the element address and status flags. Each element descriptor can also contain sense code information as well as other information, depending on the element type.

Medium Transport Element Descriptor

The medium transport element is the cartridge loader (robot). The library contains one cartridge loader, for which it returns the following medium transport element descriptor.

Byte \ Bit	7	6	5	4	3	2	1	0
00	(MSB) Element Address							
01								(LSB)
02	Reserved					Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	Reserved							
07								
08								
09	SValid	Invert	Reserved					
10	(MSB) Source Storage Element Address							
11								(LSB)
12 ... 47	Primary Volume Tag Information (field omitted if PVolTag = 0)							
48 ... 51	Reserved (field moved up if PVolTag = 0)							

Medium Transport Element Descriptor Fields

Element Address	This field contains the element address of the medium transport element (cartridge loader).	
Except	The Except (exception) bit indicates the current state of the cartridge loader, as follows:	
	0	The cartridge loader is in a normal state.
	1	The cartridge loader is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.
Full	This field indicates if the cartridge loader contains a cartridge. The possible values for this field are as follows:	
	0	The cartridge loader does not contain a cartridge.
	1	The cartridge loader contains a cartridge.
Additional Sense Code (ASC)	If the cartridge loader is in an abnormal state, this field contains the value 83h. Refer to Table 4-18 on page 136 for the corresponding ASCQ values and a corrective action for each abnormal state.	
Additional Sense Code Qualifier (ASCQ)	The values for this field are listed in Table 4-18 on page 136, along with the corrective action to take for each abnormal state.	
SValid	The values for this bit indicate the following:	
	0	The Source Storage Element Address field (bytes 10 and 11) is invalid.
	1	The Source Storage Element Address field (bytes 10 and 11) is valid.
Invert	The library uses single-sided media and does not support inverting of the media. The information reported for this field is 0.	
Source Storage Element Address	This field shows the address of the last storage element from which the cartridge was moved.	
Primary Volume Tag Information	When the PVolTag field (in the Element Status page described on page 122 is set to 1, this field contains the volume tag (bar code label) information of the cartridge in the cartridge loader. The library supports only eight bytes of volume tag information, so only the first eight bytes reported are valid.	

Storage Element Descriptor

Each of the library's cartridge cells is a storage element. If the library's Limit Number of Cells option is turned on, the number of storage elements reported is equal to the number of addressable cells specified.

- **StorageLibraryT24**—The maximum number of cartridge cells is 24.
- **StorageLoader 2U**—The maximum number of cartridge cells is 20.

For each storage element, the library returns the following storage element descriptor.

Byte \ Bit	7	6	5	4	3	2	1	0
00	(MSB)			Element Address				
01								(LSB)
02	Reserved				Access	Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	Reserved							
07								
08								
09	SValid	Invert	Reserved					
10	(MSB)			Source Storage Element Address				
11								(LSB)
12 ... **47**	Primary Volume Tag Information (field omitted if PVolTag = 0)							
48 ... **51**	Reserved (field moved up if PVolTag = 0)							

Storage Element Descriptor Fields

Element Address	This field contains the address of the cartridge storage location (cartridge cell).	
Access	This bit indicates whether the cartridge loader can access the cartridge at that location.	
	0	The cell is accessible.
	1	The cell is not currently accessible.
Except	The Except (exception) bit indicates the current state of the cartridge cell, as follows:	
	0	The cartridge cell is in a normal state.
	1	The cartridge cell is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.
Full	This bit indicates whether the cartridge cell contains a cartridge, as follows:	
	0	The cell does not contain a cartridge.
	1	The cell contains a cartridge.
Additional Sense Code (ASC)	If the Except bit is set to 1, this field contains the value 83h. Refer to Table 4-18 on page 136 for the corresponding ASCQ values and a corrective action for each abnormal state.	
Additional Sense Code Qualifier (ASCQ)	The values for this field are listed in Table 4-18 on page 136, along with the corrective action to take for each abnormal state.	
SValid	The values for this bit indicate the following:	
	0	The Source Storage Element Address field (bytes 10 and 11) is invalid.
	1	The Source Storage Element Address field (bytes 10 and 11) is valid.
Invert	0	The library uses single-sided media and does not support inverting of the media.
Source Storage Element Address	This field shows the address of the last storage element from which the cartridge was moved.	
Primary Volume Tag Information	When the PVolTag field (in the Element Status page described on page 122 is set to 1, this field contains the volume tag (bar code label) information of the cartridge in the storage location. The library supports eight bytes of volume tag information, so only the first eight bytes reported are valid.	

Import/Export Element Descriptor

If enabled, the library has the following I/E port elements (cartridge access ports), for which it returns the following I/E element descriptor.

Byte \ Bit	7	6	5	4	3	2	1	0
00	(MSB) Element Address							
01								(LSB)
02	Reserved		INENAB	EXENAB	Access	Except	IMPEXP	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	Reserved							
07								
08								
09	SValid	Invert	Reserved					
10	(MSB) Source Storage Element Address							
11								(LSB)
12 ... 47	Primary Volume Tag Information (field omitted if PVolTag = 0)							
48 ... 51	Reserved (field moved up if PVolTag = 0)							

Import/Export Element Descriptor Fields

INENAB (Import Enable)	This field indicates whether the I/E port element supports movement of media into the cartridge handler.	
	0	Medium may not be imported into cartridge handler from I/E port.
	1	Medium may be imported into cartridge handler from I/E port.
EXENAB (Export Enable)	This field indicates whether the I/E port element supports movement of media from the cartridge handler into the I/E port element.	
	0	Medium may not be exported into the I/E port.
	1	Medium may be exported into the I/E port.

IMPEXP (Import Export)	This field indicates where the unit of media in the I/E port element originated.	
	0	Medium in the I/E port was placed there by the cartridge handling system.
	1	Medium in the I/E port was placed there by the operator.
Access	This bit indicates whether the cartridge loader can access the cartridge at that location.	
	0	The cell is not currently accessible.
	1	The cell is accessible.
Except	The Except (exception) bit indicates the current state of the cartridge cell, as follows:	
	0	The cartridge cell is in a normal state.
	1	The cartridge cell is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.
Full	This bit indicates whether the cartridge cell contains a cartridge, as follows:	
	0	The cell does not contain a cartridge.
	1	The cell contains a cartridge.
Additional Sense Code (ASC)	If the Except bit is set to 1, this field contains the value 83h. Refer to Table 4-18 on page 136 for the corresponding ASCQ values and a corrective action for each abnormal state.	
Additional Sense Code Qualifier (ASCQ)	The values for this field are listed in Table 4-18 on page 136, along with the corrective action to take for each abnormal state.	
SValid	The values for this bit indicate the following:	
	0	The Source Storage Element Address field (bytes 10 and 11) is invalid.
	1	The Source Storage Element Address field (bytes 10 and 11) is valid.
Invert	The library uses single-sided media and does not support inverting of the media. The value reported for this field is 0.	
Source Storage Element Address	This field shows the address of the last storage element from which the cartridge was moved.	
Primary Volume Tag Information	When the PVolTag field is set to 1, this field contains the volume tag (bar code label) information of the cartridge in the storage location. The library supports eight bytes of volume tag information, so only the first eight bytes reported are valid.	

Data Transfer Element Descriptor

The library has the following data transfer elements (tape drives), for which it returns the following data transfer element descriptor.

Byte \ Bit	7	6	5	4	3	2	1	0
00	(MSB) Element Address							
01								(LSB)
02	Reserved				Access	Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	RSVD	RSVD	IDValid	LUValid	RSVD	Logical Unit Number		
07	SCSI Bus Address							
08	Reserved							
09	SValid	Invert	Reserved					
10	(MSB) Source Storage Element Address							
11								(LSB)
12 ... 47	Primary Volume Tag Information (omitted if PVolTag = 0)							
48	Reserved				Code Set 1			
49	Reserved				Identifier Type 1			
50	Reserved							
51	Identifier Length 1 (22h)							
52 ... 85	(MSB) Device Identifier 1 (omitted if DVCID = 0) (field moved up if PVolTag = 0)							(LSB)
86	Reserved				Code Set 2			
87	Reserved				Identifier Type 2			
88	Reserved							
89	Identifier Length 2 (8h)							
90 ... 97	(MSB) Device Identifier 2 (omitted if DVCID = 0)							(LSB)
98 ... 107	(MSB) (Obsolete) Tape Drive Serial Number (omitted if S/N Req = 0)							(LSB)

Data Transfer Element Descriptor Fields

Element Address	This field contains the address of the data transfer element (the tape drive).	
	51 h	The default starting address for the tape drives.
Access	This bit indicates whether the cartridge loader can pick or place a cartridge at the tape drive location. The cartridge is accessible if it is ejected from the tape drive. Accessibility is reported as follows:	
	0	The tape drive location may not be accessible (a cartridge is loaded in the tape drive, or the tape drive's status is unknown).
	1	The tape drive location is accessible (a cartridge is protruding from the tape drive, or the drive is empty).
Except	The Except (exception) bit indicates the current state of the tape drive, as follows:	
	0	The tape drive is in a normal state.
	1	The tape drive is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.
Full	This bit indicates if the tape drive contains a cartridge, as follows:	
	0	The tape drive does not contain a cartridge.
	1	The tape drive contains a cartridge.
Additional Sense Code (ASC)	If the tape drive is in an abnormal state, this field contains the value 83h. Refer to Table 4-18 on page 136 for the corresponding ASCQ values and a corrective action for each abnormal state.	
Additional Sense Code Qualifier (ASCQ)	The values for this field are listed in Table 4-18 on page 136, along with the corrective action to take for each abnormal state.	
IDValid	This bit indicates that the SCSI Bus Address field (byte 07) contains valid information as follows:	
	0	The SCSI Bus Address field is not valid because a tape drive is not installed at this location.
	1	The SCSI Bus Address field is valid because a tape drive is installed at this location.
LUValid	This bit indicates that the Logical Unit Number field (byte 06, bits 2 through 0) contains valid information as follows:	
	0	The Logical Unit Number field is not valid because a tape drive is not installed at this location.
	1	The Logical Unit Number field is valid because a tape drive is installed at this location.

Logical Unit Number	The value reported for this field is 0.	
SCSI Bus Address	The value reported for this field is the tape drive's SCSI ID.	
SValid	The values for this bit indicate the following:	
	0	The Source Storage Element Address field (bytes 10 and 11) is invalid.
	1	The Source Storage Element Address field (bytes 10 and 11) is valid.
Invert	0	The library uses single-sided media and does not support inverting the media.
Source Storage Element Address	This field shows the address of the last storage element from which the cartridge was moved.	
Primary Volume Tag Information	When the PVolTag field is set to 1, the Primary Volume Tag Information field contains the volume tag (bar code label) information of the element being reported by this element descriptor. The library supports eight bytes of volume tag information, so only the first eight bytes reported are valid.	
Code Set 1	The value returned for this field is 2h, which indicates that the Device Identifier 1 field (Bytes 52-85) contains ASCII characters. If DVCID is 0, the value for this field is set to 0.	
Identifier Type 1	The value returned for this field is 1h, which indicates that the first eight bytes of the field contain the tape drive's Vendor Identification as returned in the tape drive's Standard Inquiry Data. If DVCID is 0, the value for this field is set to 0.	
Identifier Length 1	The value returned for this field is 22h if DVCID is set to 1, which indicates that the length of the Device Identifier field is 34 (22h) bytes, excluding this byte. If DVCID is 0, the value for this field is set to 0.	

Device Identifier 1	This field contains the tape drive's device identifier from the INQUIRY Device Identification page (page code 83h), starting at byte 8, as returned by the tape drive. Refer to the tape drive's documentation for additional information.
Code Set 2	The value returned for this field is 1h, which indicates that the Device Identifier 2 field (bytes 90 through 97) contains binary data.
Identifier Type 2	The value returned for this field is 2h, which indicates that the Device Identifier 2 field contains a 64-bit canonical form IEEE Extended Unique Identifier.
Identifier Length 2	The value returned for this field is 08h, which indicates that the length of the Device Identifier 2 field is 8 bytes. **Note:** If the DVCID bit in the CDB is 0, this field is omitted.
Device Identifier 2	The value returned for this field is 0. **Note:** If the DVCID bit in the CDB is 0, this field is omitted.
Tape Drive Serial Number	This field is obsolete and only retained for compatibility. The DVCID field should be used to match drives to libraries according to their Identification Descriptors from Inquiry page 83h.

ASC and ASCQ Values for Abnormal States

Table 4-17 contains a list of the ASC and ASCQ values that will appear in the Additional Sense Code and Additional Sense Code Qualifier fields of an element descriptor if the element is in an abnormal state. Table 4-17 also indicates the corrective action for each abnormal state. The Except field of an element descriptor indicates if the element is in an abnormal state.

Good	The library returns Good status when it is able to process the command without errors.
Busy	Busy status indicates that the library is temporarily unable to accept a command from this initiator. The initiator may retry the command later.
Reservation Conflict	The library returns Reservation Conflict status when it is reserved by a different initiator. See page 157 for more information about the RESERVE command.
Check Condition	The library returns Check Condition status for the following reasons: ▸ The command is issued to an invalid LUN. ▸ A Unit Attention condition is pending for the initiator. ▸ The library is not ready because a magazine is removed. ▸ A reserved bit is set to 1 in the CDB. ▸ A parameter in the CDB is invalid (see Table 4-18 for sense data).

***Table 4-17** ASC and ASCQ values for abnormal element conditions*

ASC	ASCQ	Description	Corrective Action
83h	00h	Label questionable	The bar code label is questionable. Issue an INITIALIZE ELEMENT STATUS (07h) or INITIALIZE ELEMENT STATUS WITH RANGE (37h) command.
83h	01h	Cannot read bar code label or invalid checksum value	Replace the label. If the error still occurs and the label is correctly placed, contact your vendor.
83h	03h	Label and full status questionable	The library was powered on or the cartridge access port door was opened. The cartridge inventory may have been violated. Issue an INITIALIZE ELEMENT STATUS (07h) or INITIALIZE ELEMENT STATUS WITH RANGE (37h) command. **Note:** If the element is a tape drive that is empty or contains a data cartridge (not ejected), issuing an INITIALIZE ELEMENT STATUS or INITIALIZE ELEMENT STATUS WITH RANGE will not change the questionability of the full status. You may want to issue an UNLOAD command to the tape drive to determine whether the tape drive is full or empty.
83h	04h	Tape drive not installed	There is no tape drive installed. Install a tape drive or ignore the error.
83h	09h	No bar code label	If the cartridge does not have a bar code label, place a label on the cartridge. If there is a bar code label and it is placed correctly, contact your vendor.

Read Element Command Status

The library returns a status byte after processing the READ ELEMENT STATUS command. This section describes when each type of status byte might be returned.

***Table 4-18** Invalid parameters in the READ ELEMENT STATUS CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	21h	01h	1	1	0	0	0002h	Invalid starting element address.
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	24h	00	1	1	1	3h	0001h	Invalid element type code.

RELEASE (17h or 57h)

The library supports both the six-byte and the ten-byte format of the RELEASE UNIT CDB. The library determines which version of the command is being used based on the operation code in the CDB. You can use either version of the command.

The RELEASE command enables you to release reservations of the library that you made with the RESERVE (16h or 56h) command.

Only the initiator that reserved the library can release the reserved library. If another initiator attempts to release a reserved library, the library returns Good status and does not release the library.

Releasing an unreserved library is not an error.

Release Six-Byte CDB (17h)

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	1	1
01	Reserved							
02								
03								
04								
05	0	0	Reserved				0	0

Release Ten-Byte CDB (57h)

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	1	0	1	0	1	1	1
01	Reserved			3rdPty (0)	Reserved		LongID (0)	RSVD
02	Reserved							
03	Third Party Device ID (0) not supported							
04 ... **09**	Reserved							

Release Command Status

The library returns a status byte after processing the RELEASE command. This section describes when each type of status byte might be returned.

Good	The library returns Good status when it is able to process the command without errors.
Busy	Busy status indicates that the library is temporarily unable to accept a command from this initiator. The initiator may retry the command later.
Reservation Conflict	The library never returns Reservation Conflict status for the RELEASE command.
Check Condition	The library returns Check Condition status for the following reasons: ▸ The command is issued to an invalid LUN. ▸ A Unit Attention condition is pending for the initiator. ▸ A reserved bit is set to 1 in the CDB. ▸ A parameter in the CDB is invalid (see Table 4-19 for sense data).

Table 4-19 *Invalid parameters in the RELEASE CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	24h	00	1	1	1	1h	0001h	LongID field is set to 1.
5h	24h	00	1	1	1	1h	0000h	Element field is set to 1.

REQUEST SENSE (03h)

The REQUEST SENSE command requests that the library transfer sense data to the initiator. The library provides sense data in only the Error Code 70h, extended sense data format. The library returns a total of 20 bytes of sense data to the initiator.

The sense data is constructed and saved on a per-initiator and requested LUN basis. The library preserves sense data for all initiators until the data is retrieved by the REQUEST SENSE command or until the library receives any other command for the same I_T_L nexus (initiator-target-LUN connection).

Sense data is available under the following circumstances:

- The previous command to the specified I_T_L nexus terminated with Check Condition status.

- The previous command to the specified I_T_L nexus terminated with an unexpected bus free error.
- The REQUEST SENSE command was issued to an unsupported LUN. In this case, the library does not return Check Condition status and returns the following sense data:

Sense key	Illegal Request (5h)
ASC	Logical unit not supported (25h)
ASCQ	00h

If no sense data is available for the specified I_T_L nexus, the library returns the following sense data:

Sense key	No Sense (0h)
ASC	No additional sense information (00h)
ASCQ	00h

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	1	1
01	Reserved							
02	Reserved							
03								
04	Allocation Length (14h)							
05	0	0	Reserved				0	0

Request Sense Data

The library returns the standard extended sense bytes, as described below.

Byte \ Bit	7	6	5	4	3	2	1	0
00	RSVD	1	1	1	0	0	0	0
01	00h							
02	0	0	0	RSVD	Sense Key			
03 ... **06**	(MSB) Information Bytes (LSB)							
07	Additional Sense Length							
08 ... **11**	(MSB) Command Specific Information (LSB)							
12	Additional Sense Code (ASC)							
13	Additional Sense Code Qualifier (ASCQ)							
14	Field Replaceable Unit Code							
15	SKSV	(MSB) Sense Key Specific						
16								
17	(LSB)							
18	Fault Symptom Code (FSC)							
19	FSC Command							

Request Sense Data Fields

<table>
<tr><td rowspan="8">Sense Key</td><td colspan="3">The following sense key values are supported:</td></tr>
<tr><td>Value</td><td>Sense Key</td><td>Description</td></tr>
<tr><td>0h</td><td>No Sense</td><td>Indicates that there is no specific sense key information to be reported for the library.</td></tr>
<tr><td>2h</td><td>Not Ready</td><td>Indicates that the library is not ready to perform cartridge loader motion commands.</td></tr>
<tr><td>3h</td><td>Medium Error</td><td>Indicates that the command terminated with a non-recovered error condition that was probably caused by a flaw in the medium or an error in the recorded data. This sense key may also be returned if the library is unable to distinguish between a flaw in the medium and a specific hardware error (sense key 4h).</td></tr>
<tr><td>4h</td><td>Hardware Error</td><td>Indicates that the library detected a hardware failure while performing the command or during a self-test. Operator intervention may be required.</td></tr>
<tr><td>5h</td><td>Illegal Request</td><td>Indicates that there was an illegal parameter in the command descriptor block or in the additional parameters supplied as data for a command, or the library is in the wrong mode to execute the command.</td></tr>
<tr><td>6h</td><td>Unit Attention</td><td>Indicates that the cartridge inventory may have been violated.</td></tr>
<tr><td>Bh</td><td>Aborted Command</td><td>Indicates that the library aborted the command. The initiator may be able to recover by trying the command again.</td></tr>
<tr><td>Information Bytes</td><td colspan="3">The library does not support this sense field and returns 0.</td></tr>
<tr><td>Additional Sense Length</td><td colspan="3">This byte indicates the total number of sense bytes that follow this byte. The value returned is 0Ch (12 bytes).</td></tr>
<tr><td>Command Specific Information</td><td colspan="3">This field is not supported by the library. The value returned is 0.</td></tr>
<tr><td>Additional Sense Code (ASC)</td><td colspan="3">This field, together with the Additional Sense Code Qualifier (byte 13), denotes a specific error condition.</td></tr>
<tr><td>Additional Sense Code Qualifier (ASCQ)</td><td colspan="3">This field, together with the Additional Sense Code (byte 12), denotes a specific error condition.</td></tr>
<tr><td>Field Replaceable Unit Code</td><td colspan="3">This field is not supported by the library. The value returned is 0.</td></tr>
<tr><td>SKSV (Sense Key Specific Valid)</td><td colspan="3">When this bit is set to 1, the information in the Sense Key Specific field is valid. The SKSV field can be set to 1 only for a sense key of Illegal Request (5h).</td></tr>
<tr><td>Sense Key Specific</td><td colspan="3">When the SKSV bit is set to 1, the information contained in this field indicates which field in the CDB or parameter list of a command caused the Check Condition status. This field, valid only for a sense key of Illegal Request (5h), is defined in the table below.</td></tr>
</table>

Sense Key Specific Data

When the SKSV bit is set to 1, the information contained in this field indicates which field in the CDB or parameter list of a command caused the Check Condition status. This field, valid only for a sense key of Illegal Request (5h), is defined as follows:

Byte \ Bit	7	6	5	4	3	2	1	0
15	SKSV	C/D	Reserved		BPV	Bit Pointer		
16	(MSB)	Field Pointers						
17								(LSB)

Sense Key Specific Data Fields

C/D (Command/Data)	Indicates whether the Check Condition status resulted from an illegal parameter in either the command descriptor block (Command) or the parameter list (Data) of a particular command, as follows:	
	0	The Check Condition status resulted from an illegal parameter in the parameter list (Data).
	1	The Check Condition status resulted from an illegal parameter in the command descriptor block (Command).
BPV (Bit Pointer Valid)	Indicates whether the value in the Bit Pointer field is valid, as follows:	
	0	The value contained in the Bit Pointer is not valid.
	1	The value contained in the Bit Pointer (byte 15, bits 2 through 0) is valid.
Bit Pointer	Specifies the bit of the byte identified by the Field Pointer (bytes 16 and 17). When a multiple-bit field is in error, the Bit Pointer contains the value of the most significant bit of the field. The most significant bit of a multiple-bit field is the bit with the highest bit number. For example, if a field consists of bits 5, 4, and 3, the most significant bit is bit 5.	
Field Pointer	Contains the number of the byte in which the error occurred. Byte numbers start at 00. When a multiple-byte field is in error, the Field Pointer contains the value of the most significant byte of the field. The most significant byte of a multiple-byte field is the byte with the lowest byte number. For example, if a field consists of bytes 02, 03, and 04, the most significant byte is byte 02.	

Priorities of Sense Bytes

Multiple errors may occur during the processing of a single SCSI command. The sense key reflects the last error that occurred. For example, if a message error occurs after an unrecoverable hardware error, the library handles the errors in the following manner:

- The message error is reported.
- A subsequent REQUEST SENSE command reports the hardware error.
- The hardware error is preserved, and the next motion command issued by any host terminates with Check Condition status.

Sense Byte Pending Status

When the library reports Check Condition status in response to a command from an initiator, the library retains the sense byte pending status, including error information and Check Condition status for the initiator, until one of the following occurs:

- Error information is reset by a reset or power-on condition.
- Error information is reset by the next command execution for the same initiator.

Request Sense Command Status

The library returns a status byte after processing the REQUEST SENSE command. This section describes when each type of status byte might be returned.

Good	The library returns Good status when it is able to process the command without errors.
Busy	The library never returns Busy status for the REQUEST SENSE command.
Reservation Conflict	The library never returns Reservation Conflict status for the REQUEST SENSE command.
Check Condition	The library returns Check Condition status for the following reasons: ▸ A reserved bit is set to 1 in the CDB. ▸ A parameter in the CDB is invalid (see Table 4-18 for sense data).

Table 4-20 *Invalid parameters in the READ ELEMENT STATUS CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.

REQUEST VOLUME ELEMENT ADDRESS (B5h)

The REQUEST VOLUME ELEMENT ADDRESS command requests that the library return the element descriptors created as a result of the SEND VOLUME TAG (B6h) command. Data is returned in element address order. For information about the SEND VOLUME TAG command, see page 160.

Note: In a multi-initiator environment, you should reserve the entire library using the RESERVE (16h or 56h) command before you request element descriptors. Do not issue the RELEASE (17h or 57h) command until after you have successfully obtained data with the REQUEST VOLUME ELEMENT ADDRESS command. You should issue commands in the following order:

1. RESERVE (16h) for the entire library
2. SEND VOLUME TAG (B6h)
3. REQUEST VOLUME ELEMENT ADDRESS (B5h)
4. RELEASE (17h)

Byte \ Bit	7	6	5	4	3	2	1	0
00	1	0	1	1	0	1	0	1
01	Reserved			VolTag	Element Type Code			
02	(MSB)	Starting Element Address						(LSB)
03								
04	(MSB)	Number of Elements						(LSB)
05								
06	Reserved							
07	(MSB)	Allocation Length						(LSB)
08								
09								
10	Reserved							
11	0	0	Reserved				0	0

Request Volume CDB Fields

VolTag	This field indicates whether you want the library to return the volume tag (bar code label) information searched for by the SEND VOLUME TAG (B6h) command. Volume tag information is obtained when the library scans the bar code label affixed to each cartridge in the library. The valid values for this field are as follows:	
	0	Do not report volume tag information.
	1	Report volume tag information.
Element Type Code	This field specifies the particular element types you want the library to report on. The library supports the following Element Type Codes:	
	0h	All element types. For an Element Type Code of 0h, the element types are reported in element address order, beginning with the Starting Element Address.
	1h	Medium Transport Element (cartridge loader).
	2h	Storage Element (cartridge cells).
	3h	I/E Port Element (cartridge access port).
	4h	Data Transfer Element (tape drives).
Starting Element Address	This field indicates the element address at which to start the transfer of data. Only elements with addresses greater than or equal to the starting address are reported. Element descriptor blocks are not generated for undefined element addresses.	
Number of Elements	This field represents the actual number of element descriptors to be returned. This is an actual number of element descriptors to be returned, not an element address range. The library returns element descriptors of the requested element type, starting with the first element address equal to or greater than the value in the Element Address field. All element descriptors are returned for the number of element descriptors specified in this field, or the number of element descriptors available, whichever is less. It is not an error to specify 0FFFFh as a value for this field if you want the library to return all available elements.	
Allocation Length	The Allocation Length specifies the total available length in bytes you are allocating for returned element descriptors. Only complete element descriptors are returned. The library returns element descriptors until *one* of the following conditions is met: ▸ All available element descriptors have been returned. ▸ The number of element descriptors specified in the Number of Elements field has been returned. ▸ The remaining allocation length is smaller than the next complete element descriptor or header to be returned.	

Volume Element Address Header

The library returns one Volume Element Address Header for each REQUEST VOLUME ELEMENT ADDRESS command that it receives.

Byte \ Bit	7	6	5	4	3	2	1	0
00	(MSB) First Element Address Reported							(LSB)
01								
02	(MSB) Number of Elements Reported							(LSB)
03								
04	Reserved			Send Action Code				
05	(MSB) Byte Count of Report Available							(LSB)
06								
07								

Volume Element Address Header Fields

First Element Address Reported	This field indicates the address of the first element that has a bar code label that matches the template sent by the SEND VOLUME TAG (B6h) command.
Number of Elements Reported	This field indicates the total number of element descriptors available to be transferred to the initiator. The status of these elements is returned if a sufficient Allocation Length value was specified in the CDB.
Send Action Code	This field contains the action code in the SEND VOLUME TAG command that created the data. The library supports a Send Action Code of 5h.
Byte Count of Report Available	This field indicates the total number of bytes of information available to be transferred to the initiator. This value is not adjusted to match the Allocation Length.

Element Status Page

The library returns one Element Status page for each group of element descriptors of the same type.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Element Type Code							
01	PVolTag	AVolTag	Reserved					
02	(MSB)	Element Descriptor Length						(LSB)
03								
04	Reserved							
05	(MSB)	Byte Count of Descriptor Data Available						(LSB)
06								
07								

Element Status Page Fields

Element Type Code	This field indicates the specific element type (see page 145) being reported by the element descriptor.	
PVolTag	This field indicates if primary volume tag (bar code label) information is present, as follows:	
	0	Volume tag bytes are omitted from the element descriptors.
	1	Volume tag information is present.
AVolTag	The library does not support alternate volume tags. The value reported for this field is 0.	
Element Descriptor Length	This field indicates the total number of bytes contained in a single element descriptor, as follows: If the descriptor being returned is for either the medium transport element (the cartridge loader) or a storage element (cartridge cell), the length is either 52 bytes (if the VolTag bit is 1) or 16 bytes (if the VolTag bit is 0). If the descriptor being returned is for a data transfer element (a tape drive), the element descriptor length changes depending on the setting of the DVCID, VolTag, and S/N Req bits, as follows:	
	VolTag	Element Descriptor Length (bytes)
	0	16
	1	52
Byte Count of Descriptor Data Available	This field indicates the total number of bytes of element descriptor data available for the elements of this element type that meet the CDB requirements. This value is not adjusted to match the value that you specified for the Allocation Length field. This value is the Element Descriptor Length multiplied by the number of element descriptors.	

Medium Transport Element Descriptor

The medium transport element is the cartridge loader (robot). The library contains one cartridge loader.

Byte \ Bit	7	6	5	4	3	2	1	0
00	(MSB)			Element Address				(LSB)
01								
02	Reserved					Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	Reserved							
07								
08								
09	SValid	Invert	Reserved					
10	(MSB)			Source Storage Element Address				(LSB)
11								
12 ... 47	Primary Volume Tag Information (field omitted if PVolTag = 0)							
48 ... 51	Reserved (field moved up if PVolTag = 0)							

Medium Transport Element Descriptor Fields

Element Address	This field contains the element address of the medium transport element (cartridge loader).	
Except	The Except (exception) bit indicates the current state of the cartridge loader, as follows:	
	0	The cartridge loader is in a normal state.
	1	The cartridge loader is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.
Full	1	This field indicates whether the cartridge loader contains a cartridge. Since no match could have been made if there were no cartridge present, the value for this field is always 1.
Additional Sense Code (ASC)	If the cartridge loader is in an abnormal state, this field contains the value 83h. Refer to Table 4-21 for the corresponding ASCQ values and a corrective action for each abnormal state.	
Additional Sense Code Qualifier (ASCQ)	The values for this field are listed in Table 4-21, along with the corrective action to take for each abnormal state.	
SValid	0	The Source Storage Element Address field (bytes 10 and 11) is invalid.
	1	The Source Storage Element Address field (bytes 10 and11) is valid.
Invert	0	The library uses single-sided media and does not support inverting of the media.
Source Storage Element Address	This field shows the address of the last storage element from which the cartridge was moved.	
Primary Volume Tag Information	When the PVolTag field (in the Element Status page described on page 147) is set to 1, this field contains the volume tag (bar code label) information of the cartridge in the cartridge loader. The library supports eight bytes of volume tag information, so only the first eight bytes reported are valid.	

Storage Element Descriptor

Each of the library's cartridge cells is a storage element. If the library's Limit Number of Cells option is turned on, or if the MaxStor and MaxStorAddr fields are set on the MODE SELECT Unique Properties Page, the number of storage elements reported is equal to the number of addressable cells specified.

- **StorageLibrary T24**—The maximum number of cartridge cells is 24.
- **StorageLoader 2U**—The maximum number of cartridge cells is 20.

For each storage element, the library returns the following storage element descriptor.

Byte \ Bit	7	6	5	4	3	2	1	0
00	(MSB)			Element Address				(LSB)
01								
02	Reserved				Access	Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	Reserved							
07								
08								
09	SValid	Invert	Reserved					
10	(MSB)			Source Storage Element Address				(LSB)
11								
12 ... 47	Primary Volume Tag Information (field omitted if PVolTag = 0)							
48 ... 51	Reserved (field moved up if PVolTag = 0)							

Storage Element Descriptor Fields

Element Address	This field contains the element address of the storage element (cartridge storage cell).	
Access	1	This bit indicates whether the cartridge loader can access the cartridge. The cartridge storage location is always accessible.
Except	The Except (exception) bit indicates the current state of the cartridge cell, as follows:	
	0	The cartridge cell is in a normal state.
	1	The cartridge cell is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.
Full	1	This bit indicates whether the cell contains a cartridge. Since no match could have been made if there was no cartridge present, the value for this bit is always 1.
Additional Sense Code (ASC)	If the cell is in an abnormal state, this field contains the value 83h. Refer to Table 4-21 for the corresponding ASCQ values and a corrective action for each abnormal state.	
Additional Sense Code Qualifier (ASCQ)	The values for this field are listed in Table 4-21, along with the corrective action to take for each abnormal state.	
SValid	0	The Source Storage Element Address field (bytes 10 and 11) is invalid.
	1	The Source Storage Element Address field (bytes 10 and 11) is valid.
Invert	0	The library uses single-sided media and does not support inverting of the media (recording on both sides of the tape).
Source Storage Element Address	This field shows the address of the last storage element from which the cartridge was moved.	
Primary Volume Tag Information	When the PVolTag field (in the Element Status page described on page 147) is set to 1, this field contains the volume tag (bar code label) information of the cartridge in this storage location. The library supports eight bytes of volume tag information, so only the first eight bytes reported are valid.	

Import/Export Element Descriptor

If enabled, the library has the following I/E port elements (cartridge access ports), for which it returns the following I/E element descriptor.

Byte \ Bit	7	6	5	4	3	2	1	0
00	(MSB) Element Address							
01								(LSB)
02	Reserved		INENAB	EXENAB	Access	Except	IMPEXP	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	Reserved							
07								
08								
09	SValid	Invert	Reserved					
10	(MSB) Source Storage Element Address							
11								(LSB)
12 ... 47	Primary Volume Tag Information (field omitted if PVolTag = 0)							
48 ... 51	Reserved (field moved up if PVolTag = 0)							

Import/Export Element Descriptor Fields

INENAB (Import Enable)	This field indicates whether the I/E port element supports movement of media into the cartridge handler.	
	0	Medium may not be imported into cartridge handler from I/E port.
	1	Medium may be imported into cartridge handler from I/E port.
EXENAB (Export Enable)	This field indicates whether the I/E port element supports movement of media from the cartridge handler into the I/E port element.	
	0	Medium may not be exported into the I/E port.
	1	Medium may be exported into the I/E port.

IMPEXP (Import Export)	This field indicates where the unit of media in the I/E port element originated.	
	0	Medium in the I/E port was placed there by the cartridge handling system.
	1	Medium in the I/E port was placed there by the operator.
Access	This bit indicates whether the cartridge loader can access the cartridge at that location.	
	0	The cell is not currently accessible.
	1	The cell is accessible.
Except	The Except (exception) bit indicates the current state of the cartridge cell, as follows:	
	0	The cartridge cell is in a normal state.
	1	The cartridge cell is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.
Full	This bit indicates whether the cartridge cell contains a cartridge, as follows:	
	0	The cell does not contain a cartridge.
	1	The cell contains a cartridge.
Additional Sense Code (ASC)	If the Except bit is set to 1, this field contains the value 83h. Refer to Table 4-21 on page 156 for the corresponding ASCQ values and a corrective action for each abnormal state.	
Additional Sense Code Qualifier (ASCQ)	The values for this field are listed in Table 4-21 on page 156, along with the corrective action to take for each abnormal state.	
SValid	0	The Source Storage Element Address field (bytes 10 and 11) is invalid.
	1	The Source Storage Element Address field (bytes 10 and 11) is valid.
Invert	The library uses single-sided media and does not support inverting of the media. The value reported for this field is 0.	
Source Storage Element Address	This field shows the address of the last storage element from which the cartridge was moved.	
Primary Volume Tag Information	When the PVolTag field (in the Element Status page described on page 147) is set to 1, this field contains the volume tag (bar code label) information of the cartridge in the storage location. The library supports eight bytes of volume tag information, so only the first eight bytes reported are valid.	

Data Transfer Element Descriptor

The library has the following data transfer elements (tape drives), for which it returns the following data transfer element descriptor.

Byte \ Bit	7	6	5	4	3	2	1	0
00	(MSB)			Element Address				(LSB)
01								
02	Reserved				Access	Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	RSVD	RSVD	IDValid	LUValid	RSVD	Logical Unit Number		
07	SCSI Bus Address							
08	Reserved							
09	SValid	Invert	Reserved					
10	(MSB)			Source Storage Element Address				(LSB)
11								
12 ... 47	Primary Volume Tag Information (omitted if PVolTag = 0)							
48 ... 51	Reserved (field moved up if PVolTag = 0)							

Data Transfer Element Descriptor Fields

Element Address	This field contains the address of the data transfer element (the tape drive).	
	51 h	The default starting address for the tape drives.
Access	This bit indicates whether the cartridge loader can pick or place a cartridge at the tape drive location. The cartridge is accessible if it is unloaded from the tape drive at that location. Accessibility is reported as follows:	
	0	The tape drive location may not be accessible (a cartridge was last reported in the tape drive but is not currently unloaded).
	1	The tape drive location is accessible (a cartridge is unloaded and waiting to be picked, or the tape drive is empty).

Except	The Except (exception) bit indicates the current state of the tape drive, as follows:	
	0	The tape drive is in a normal state.
	1	The tape drive is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.
Full	1	This bit indicates if the tape drive contains a cartridge. Since a match could have been made only if there was a cartridge present, the value for this bit is always 1.
Additional Sense Code (ASC)	If the tape drive is in an abnormal state, this field contains the value 83h. Refer to Table 4-21 for the corresponding ASCQ values and a corrective action for each abnormal state.	
Additional Sense Code Qualifier (ASCQ)	The values for this field are listed in Table 4-21, along with the corrective action to take for each abnormal state.	
IDValid	This bit indicates that the SCSI Bus Address field (byte 07) contains valid information as follows:	
	0	The SCSI Bus Address field is not valid because a tape drive is not installed at this location.
	1	The SCSI Bus Address field is valid because a tape drive is installed at this location.
LUValid	This bit indicates that the Logical Unit Number field (byte 06, bits 2 through 0) contains valid information as follows:	
	0	The Logical Unit Number field is not valid because a tape drive is not installed at this location.
	1	The Logical Unit Number field is valid because a tape drive is installed at this location.
Logical Unit Number	The value reported for this field is 0.	
SCSI Bus Address	The value reported for this field is the tape drive's SCSI ID.	
SValid	The values for this bit indicate the following:	
	0	The Source Storage Element Address field (bytes 10 and 11) is invalid.
	1	The Source Storage Element Address field (bytes 10 and 11) is valid.
Invert	0	The library uses single-sided media and does not support inverting the media.
Source Storage Element Address	This field shows the address of the last storage element from which the cartridge was moved.	
Primary Volume Tag Information	When the PVolTag field is set to 1, the Primary Volume Tag Information field contains the volume tag (bar code label) information of the element being reported by this element descriptor. The library supports eight bytes of volume tag information, so only the first eight bytes reported are valid.	

ASC and ASCQ Values for Abnormal States

Table 4-21 contains a list of the ASC and ASCQ values that appear in the Additional Sense Code and Additional Sense Code Qualifier fields of an element descriptor if the element is in an abnormal state. Table 4-21 also indicates the corrective action for each abnormal state. The Except field of an element descriptor indicates if the element is in an abnormal state.

Table 4-21 *ASC and ASCQ values for abnormal element conditions*

ASC	ASCQ	Description	Corrective Action
83h	00h	Label questionable	▸ The bar code label is questionable. Issue an INITIALIZE ELEMENT STATUS (07h or 37h) command to reread the label. ▸ Replace the label. ▸ If the error persists, contact your service provider.
83h	01h	Cannot read bar code label	▸ Replace the label. ▸ If the error persists and the label is properly placed, contact your service provider.
83h	03h	Label and full status questionable	The library was powered onor the cartridge access port door was opened. The cartridge inventory may have been violated. Issue an INITIALIZE ELEMENT STATUS (07h or 37h) command to reestablish the cartridge inventory.
83h	09h	No bar code label	▸ If the cartridge does not have a bar code label, place a label on the cartridge. ▸ If error persists and a label is present and properly placed, contact your service provider.

Request Volume Element Address Command Status

The library returns a status byte after processing the REQUEST VOLUME ELEMENT ADDRESS command. This section describes when each type of status byte might be returned.

Good	The library returns Good status when it is able to process the command without errors.
Busy	Busy status indicates that the library is temporarily unable to accept a command from this initiator. The initiator may retry the command later.
Reservation Conflict	The library returns Reservation Conflict status when it is reserved by a different initiator. See page 157 for more information about the RESERVE command.
Check Condition	The library returns Check Condition status for the following reasons: ▸ The command is issued to an invalid LUN. ▸ A Unit Attention condition is pending for the initiator. ▸ A reserved bit is set to 1 in the CDB. ▸ The library is not ready because a magazine is removed or the library is operating in panel mode. ▸ A parameter in the CDB is invalid (see Table 4-22 for sense data).

Table 4-22 *Invalid parameters for REQUEST VOL ELEMENT ADDRESS*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	21h	01h	1	1	0	0	0002h	Invalid starting element address.
5h	24h	00h	1	1	1	3h	0001h	Invalid element type code.

RESERVE (16h or 56h)

The library supports both the six-byte and the ten-byte format of the RESERVE UNIT CDB. The library determines which version of the command is being used based on the operation code in the CDB. You can use either version of the command. Reservations can be released with a RELEASE (17h or 57h) command from the same initiator, a reset, or a power-on of the library.

Notes: If the library is reserved as a unit, the library processes only the following commands from another initiator:

- INQUIRY
- RELEASE
- REQUEST SENSE
- PREVENT/ALLOW MEDIUM REMOVAL with Prevent=00b

All other commands result in a Reservation Conflict (18h) status.

Reserve Six-Byte CDB (16h)

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	1	0
01	Reserved							
02								
03								
04								
05	0	0	Reserved				0	0

Reserve Ten-Byte CDB (56h)

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	1	0
01	Reserved							
02								
03	Third Party Device ID (0) not supported							
04 ... **06**	Reserved							
07	(MSB)	Parameter List Length (0)						(LSB)
08								
09	0	0	Reserved				0	0

Reserve Command Status

The library returns a status byte after processing the RESERVE command. This section describes when each type of status byte might be returned.

Good	The library returns Good status when it is able to process the command without errors.
Busy	Busy status indicates that the library is temporarily unable to accept a command from this initiator. The initiator may retry the command later.
Reservation Conflict	The library returns Reservation Conflict status when it is reserved by a different initiator. See page 157 for more information about the RESERVE command.
Check Condition	The library returns Check Condition status for the following reasons: ▸ The command is issued to an invalid LUN. ▸ A Unit Attention condition is pending for the initiator. ▸ A reserved bit is set to 1 in the CDB. ▸ A parameter in the CDB or element descriptor data is invalid (see Table 4-23 for sense data).

Table 4-23 *Invalid parameters for RESERVE CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	1Ah	00h	1	1	0	0	0003h	Invalid Element List Length.
5h	24h	00h	1	1	1	3h	0001h	Error in Third Party Device field.
5h	24h	00h	1	1	1	4h	0001h	Error in 3rdPty field.
5h	26h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	26h	00h	1	0	0	0	0000h[a]	Reserved field not 0.
5h	26h	00h	1	0	0	0	0001h[a]	Reserved field not 0.
5h	26h	02h	1	0	0	0	—[b]	Overlapped element address in element list descriptor.
5h	26h	02h	1	0	0	0	0004h[a]	Invalid element address.
5h	26h	02h	1	1	0	0	0002h[a]	Element reservation attempted when LUN is already reserved by this initiator.

[a] You can send more than one Element List Descriptor at a time. Add six to this field pointer value for each subsequent descriptor.

[b] The Field Pointer depends on the number of element descriptors sent.

REZERO UNIT (01h)

The REZERO UNIT command is implemented to provide software compatibility when it is required. Because the library does not need to calibrate its mechanics, it always returns an immediate Good status in response to this command.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	0	1
01	Reserved							
02								
03								
04								
05								

SEND VOLUME TAG (B6h)

The SEND VOLUME TAG command requests that the library scan the bar code labels affixed to the cartridges and compare this volume tag information with a template sent as part of a parameter list to this command. To obtain the results of the scan performed by this command, use the REQUEST VOLUME ELEMENT ADDRESS (B5h) command.

Byte \ Bit	7	6	5	4	3	2	1	0
00	1	0	1	1	0	1	1	0
01	Reserved				Element Type Code			
02	(MSB) Starting Element Address (LSB)							
03								
04	Reserved							
05	Reserved			Send Action Code				
06	Reserved							
07								
08	(MSB) Parameter List Length (LSB)							
09								
10	Reserved							
11	0	0	Reserved				0	0

Send Volume Tag CDB Fields

Element Type Code	This field specifies the particular element types you want the library to report on. The library supports the following Element Type Codes:	
	0h	All element types. For an Element Type Code of 0h, the element types are reported in element address order, beginning with the Starting Element Address.
	1h	Medium Transport Element (cartridge loader).
	2h	Storage Element (cartridge cells).
	3h	I/E Port Element (cartridge access port).
	4h	Data Transfer Element (tape drives).
Starting Element Address	This field specifies the minimum element address at which to start the search for volume tag information that matches the template in the parameter list (see below). Only elements with addresses greater than or equal to the Starting Element Address are searched. **Note:** The Starting Element Address must be 0 or a valid element address for the library, but does not have to be an address of the type requested in the Element Type Code. Only the elements of the requested element type are searched.	
Send Action Code	This field defines the specific function to be performed by this command. The library supports a Send Action Code of 5h (translate, search all primary volume tags, and ignore sequence numbers).	
Parameter List Length	This field specifies the length of the parameter list following this command. The minimum length of the parameter list is 32 bytes (20h). The maximum length is 40 bytes (28h).	

Send Volume Tag Parameter List

Byte \ Bit	7	6	5	4	3	2	1	0
00 **...** **31**	Volume Identification Template Field							
32 **...** **39**	Reserved							

Volume Identification Template Field

This field contains 32 bytes of volume identification information, which the library compares to the volume tag (bar code) information stored in nonvolatile memory. Only the first eight bytes are valid. Any additional bytes must be 0 (null). The template is considered terminated after the first 0 byte is detected. This field may contain the following characters:

? (3Fh	This character matches any single character at that position within the field.
* (2Ah)	This character is a wild card that matches any characters from that point on in that field. All characters past the "*" in the field are ignored.

Examples of valid templates are as follows:

Table 4-24 *Examples of Valid Templates*

Template	Matches
123?5678	12305678 12315678 and so on
123*5678	123___ (Any information starting with "123"; 5678 is ignored.)

Send Volume Tag Command Status

The library returns a status byte after processing the SEND VOLUME TAG command. This section describes when each type of status byte might be returned.

Good	The library returns Good status when it is able to process the command without errors.
Busy	Busy status indicates that the library is temporarily unable to accept a command from this initiator. The initiator may retry the command later.
Reservation Conflict	The library returns Reservation Conflict status when it is reserved by a different initiator.
Check Condition	The library returns Check Condition status for the following reasons: ▸ The command is issued to an invalid LUN. ▸ A Unit Attention condition is pending for the initiator. ▸ The library is not ready because a magazine is removed. ▸ A reserved bit is set to 1 in the CDB. ▸ A parameter in the CDB or parameter list is invalid (see Table 4-26 for sense data).

Table 4-25 *Invalid parameters for SEND VOLUME TAG CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	1Ah	00h	1	1	0	0	0008h	Invalid Parameter List Length.
5h	21h	01h	1	1	0	0	0002h	Invalid Starting Element Address.
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	24h	00h	1	1	1	3	0001h	Invalid Element Type Code.
5h	24h	00h	1	1	1	4	0005h	Invalid Send Action Code.
5h	26h	00h	1	0	0	0	—[a]	Invalid reserved field in parameter list.

[a] The field pointer is set to the first reserved field in the parameter list that contains a non-zero value (that is, 8, 9, 10, . . . , 38, 39).

TEST UNIT READY (00h)

The TEST UNIT READY command allows the initiator to determine if the library is ready to accept all other valid commands, including motion commands. This is not a request for a library self-test, which occurs at power-on. If the library is ready to accept any valid command without returning Check Condition, Reservation Conflict, or Busy status, this command returns Good status.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	0	0
01	Reserved							
02								
03								
04								
05	0	0	Reserved				0	0

Test Unit Ready Command Status

The library returns a status byte after processing the TEST UNIT READY command. This section describes when each type of status byte might be returned.

Good	The library returns Good status when it is able to process the command without errors.
Busy	Busy status indicates that the library is temporarily unable to accept a command from this initiator. The initiator may retry the command later.
Reservation Conflict	The library returns Reservation Conflict status when it is reserved by a different initiator.
Check Condition	The library returns Check Condition status for the following reasons: ▸ The command is issued to an invalid LUN. ▸ A Unit Attention condition is pending for the initiator. ▸ The library has experienced an unrecoverable hardware error. ▸ The library is not ready because a magazine is removed. ▸ A reserved bit is set to 1 in the CDB. ▸ A parameter in the CDB or parameter list is invalid (see Table 4-26 for sense data).

Table 4-26 *Invalid parameters for TEST UNIT READY CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.

5

RDX QuikStation Tape Drives

Supported SCSI Command

This section describes the SCSI commands supported by the tape drive. The host (or initiator) uses these commands to interact with the tape drive. This section also describes the command status information returned by the tape drive.

Table 5-1 shows the SCSI commands supported by the tape drive.

Table 5-1 *RDX tape drive SCSI command set*

Command	Operation code (hex)	What the tape drive does in response to this command	Described in...
ERASE	19h	Erases the tape starting from the current legal position to the physical end of tape (PEOT). Rewinds the tape when finished.	page 167
INQUIRY	12h	Provides the initiator with information about the tape drive's device parameters, including product and vendor identification.	page 169
LOAD/ UNLOAD	1Bh	Loads or unloads a data cartridge. When loading a cartridge, the tape drive places the tape in the tape path and positions it at the logical beginning of tape (LBOT). When unloading a data cartridge, the tape drive writes any buffered information to the tape, rewinds the tape to the physical beginning of the tape (PBOT), removes the tape from the tape path, and ejects the data cartridge (unless ejection has been prevented by a PREVENT/ALLOW MEDIUM REMOVAL command).	page 180
LOCATE	2Bh	Positions the tape at a specified logical position. (Typically, this position is determined by data that was obtained through a previous READ POSITION command.)	page 183
LOG SENSE	4Dh	Returns the values of the counters managed by the LOG SELECT command.	page 186

Table 5-1 *RDX tape drive SCSI command set (continued)*

Command	Operation code (hex)	What the tape drive does in response to this command	Described in...
MODE SELECT	15h	Changes the tape drive's internal medium, logical unit, or device parameters to values specified by the initiator.	page 199
MODE SENSE	1Ah	Provides the initiator with information about the tape drive's internal medium, logical unit, and device parameters.	page 216
PREVENT/ ALLOW MEDIUM REMOVAL	1Eh	Prevents or allows the removal of the data cartridge from the tape drive. When the PREVENT MEDIUM REMOVAL command is in effect, the tape drive's eject button is disabled.	page 232
READ	08h	Transfers data from the tape to the initiator.	page 234
READ BLOCK LIMITS	05h	Provides the initiator with information about the maximum and minimum logical block lengths that the tape drive can support for read and write operations in the current operating mode.	page 240
READ BUFFER	3Ch	Creates a diagnostic listing of the tape drive's current state or the contents of the tape drive's data buffer.	page 241
READ POSITION	34h	Reports the current logical position of the tape to the initiator. This allows the initiator to store the position for later use in locating data with a LOCATE command.	page 241
RELEASE UNIT	17h	Releases the tape drive from exclusive use by the initiator that had previously reserved it with a RESERVE UNIT command.	page 245
REQUEST SENSE	03h	Provides the initiator with sense information describing a condition that just occurred.	page 247
RESERVE UNIT	16h	Reserves the tape drive for exclusive use by the initiator that issued the command or for a third party.	page 253
REWIND	01h	Rewinds the tape to the logical beginning of the tape (LBOT).	page 254
SPACE	11h	Searches forward or backward on the tape a specified number of logical blocks, filemarks, or setmarks.	page 257
TEST UNIT READY	00h	Indicates whether the tape drive is ready to accept a medium access command (such as READ or WRITE) from the initiator.	page 264
WRITE	0Ah	Accepts data from the initiator to be written to the tape.	page 265
WRITE BUFFER	3Bh	Transfers new microcode from the initiator into the tape drive's control memory.	page 270
WRITE FILEMARKS	10h	Writes any data remaining in the tape drive's buffer to the tape, then writes a specified type and number of filemarks or setmarks following the data.	page 270

ERASE (19h)

The ERASE command causes the tape drive to perform one the following types of erase operations:

- A short erase (byte 01, bit 0 equals zero) writes an EOD at the logical beginning of the tape (LBOT).
- A long erase (byte 01, bit 0 equals one) erases all data from the tape (long erase), starting at the current valid tape position to the physical end of tape (PEOT).

When the erase operation is successfully completed, the tape drive automatically rewinds the tape to the logical beginning of tape (LBOT).

The tape drive performs the erase operation at the same speed as it performs the READ and WRITE commands.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	1	1	0	0	1
01	Reserved						Immed	Long
02	Reserved							
03								
04								
05	Control							

Notes: If the ERASE command is received after a WRITE (0Ah) or WRITE FILEMARKS (10h) command, the tape drive writes any buffered data, filemarks, and setmarks to tape before performing the erase operation. If an error occurs while it is writing the buffered data to the tape, the tape drive returns Check Condition status and does not perform the erase operation.

! Important If you reformat tape, the actual data is not erased and remains on the tape (although it is not accessible by commercial software). For this reason, if you are concerned about data remaining on a tape, do not use reformatting as a way to erase data. You must explicitly perform a long erase operation to erase the data after reformatting the tape.

CDB Field Definitions

Byte 01, Bit 1 – Immed

This bit determines when command status is returned to the initiator:

0	Status is returned when the ERASE command is completed
1	Status is returned when the ERASE command is started

If the buffer contains data from a previous WRITE command, the tape drive does not execute the ERASE command until the data in the buffer is written to the tape and an EOD mark is appended. The tape drive then performs the erase operation as follows:

- **If the Immed bit is set to 1,** the tape drive returns Good status and performs the erase operation.
- **If the Immed bit is set to 0**, the tape drive returns status when the erase and rewind operations are complete.

Byte 01, Bit 0 – Long

This bit determines the amount of tape to be erased, as follows:

0	An EOD mark is written at the logical beginning of the tape (LBOT). No data is erased. The tape drive returns Good status.
1	The data on tape is erased beginning at the current position to the physical end of tape (PEOT).

Tape Positioning

The ERASE command can only be performed at the following valid tape positions:

- Logical beginning of tape (LBOT)
- End of data mark (EOD)
- Beginning of tape (BOT) side of a filemark
- End of tape (EOT) side of a filemark
- BOT side of a setmark
- EOT side of a setmark

Exceptions and Error Conditions

Table 5-2 lists exceptions and error conditions that cause the tape drive to return Check Condition status for the ERASE command.

Table 5-2 *REQUEST SENSE data for ERASE command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Explanation
02h	04h	01h	**Not Ready.** Logical unit not ready, but is in process of becoming ready (rewinding or loading tape).
02h	04h	03h	**Not Ready.** Logical unit not ready. Manual intervention is required.
02h	3Ah	00h	**Not Ready.** Logical unit not ready. Command requires a tape, and no tape is present.
03h	30h	02h	**Medium Error.** The tape format is incompatible with the tape drive hardware or microcode.
03h	31h	01h	**Medium Error.** The tape format is corrupted.
03h	50h	00h	**Medium Error.** The tape drive could not locate a valid splice location on the tape. The tape is not located at a valid write position or the tape drive could not locate the valid write position.
04h	15h	01h	**Hardware Error.** The tape drive cannot position the tape correctly.
04h	51h	00h	**Hardware Error.** The erase operation failed.
06h	30h	00h	**Unit Attention.** Incompatible media was rejected after the cartridge was inserted.
07h	27h	00h	**Data Protect.** Attempted to erase a data cartridge that is write protected.

INQUIRY (12h)

The INQUIRY command requests that information about the tape drive's parameters be sent to the initiator.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	1	0	0	1	0
01	Reserved							EVPD
02	Page Code							
03	Reserved							
04	Allocation Length							
05	Control							

CDB Field Definitions

Byte 01, Bit 0 – EVPD (Enable Vital Product Data)

This field indicates the type of Inquiry data being requested by the initiator, as follows:

0	Return Standard Inquiry Data The value of the Page Code field (byte 02) must be 0.
1	Return one of the Vital Product Data pages, based on the value of the Page Code field.

Byte 02 – Page Code

This field specifies the page number of the Vital Product Data page to be returned to the initiator, as follows:

00h	Supported Vital Product Data page
80h	Unit Serial Number page
83h	Device Identification page
C0h	Original Inquiry Data page

If the EVPD bit (byte 1, bit 0) is set to 0, the Page Code must be 00h.

Byte 04 – Allocation Length

This field specifies the number of bytes allocated by the initiator for the Inquiry data returned by the tape drive. Any value between 00h and FFh is valid. An allocation length of 00h indicates that no data is to be returned.

The tape drive terminates the Data In phase when the number of bytes specified in the Allocation Length field has been transferred or when all available Inquiry data has been transferred, whichever is less.

What the Tape Drive Returns

The data returned by the tape drive depends on the values specified in the INQUIRY CDB. Table 5-3 summarizes the values you must specify in the INQUIRY CDB to return the different types of Inquiry data.

Table 5-3 *CDB values for different types of Inquiry data*

To return this Inquiry data...	Set these fields to...		And specify this value for the Allocation Length...	Number of bytes returned (hex)
	EVPD	Page Code		
Standard Inquiry Data	0	00h	any value from 0 to FFh	0 to 108 bytes (00h to 6Ch)
Supported Vital Product Data page	1	00h	08h	8 bytes (08h)
Unit Serial Number page	1	80h	0Eh	14 bytes (0Eh)
Device Identification page	1	83h	2Ah	44 bytes (2Ch)
Original Inquiry Data page	1	C0h	6Ch	108 bytes (6Ch)

Standard Inquiry Data

The tape drive returns the Standard Inquiry Data when the EVPD bit in the CDB is 0.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	RMB	Device-Type Modifier						
02	ISO Version		ECMA Version			ANSI Version		
03	AERC	TrmTsk	Reserved		Response Data Format			
04	Additional Length							
05	Reserved							
06								
07	RelAdr	WBus32	WBus16	Sync	Linked	RSVD	CmdQue	SftRe
08 ⋮ 15	Vendor Identification							
16 ⋮ 31	Product Identification							
32 ⋮ 35	Product Revision Level							
36 ⋮ 57	Reserved							

Byte 00, Bits 7 through 5 – Peripheral Qualifier

The Peripheral Qualifier indicates whether a device of the type specified in Peripheral Device Type field is currently connected to the specified logical unit (LUN), as follows:

000b	The specified device type is currently connected to this logical unit.
011b	The LUN is invalid (the LUN in the CDB or in the Identify message was not 0).

Byte 00, Bits 4 through 0 – Peripheral Device Type

The Peripheral Device Type identifies the device currently connected to the specified logical unit (LUN), as follows:

00001b	The device (the tape drive) is a sequential access device.
11111b	The device type is unknown or there is no device type (the LUN in the CDB or in the Identify message was not 0).

Byte 01, Bit 7 – RMB (Removable Media)

The value returned for this field is 1, indicating that the media is removable.

Byte 01, Bits 6 through 0 – Device-Type Modifier

The tape drive does not support the Device-Type Modifier. The value for this field is 0.

Byte 02, Bits 7 and 6 – ISO Version

The value returned for this field is 000b, indicating that the tape drive does not claim compliance with the International Standardization Organization (ISO) version of SCSI.

Byte 02, Bits 5 through 3 – ECMA Version

The value returned for this field is 000b, indicating that the tape drive does not claim compliance with the European Computer Manufacturers Association (ECMA) version of SCSI.

Byte 02, Bits 2 through 0 – ANSI Version

The value returned for this field is 011b, indicating that the tape drive supports the current version of the *SCSI-3 Primary Commands (SPC)* standard.

Byte 03, Bit 7 – AERC (Asynchronous Event Reporting Capability)

The value returned for this field is 0, indicating that the tape drive does not have asynchronous event notification capability.

Byte 03, Bit 6 – TrmTsk (Terminate Task)

The value returned for this field is 0, indicating that the tape drive does not support the Terminate Task management function.

Byte 03, Bits 3 through 0 – Response Data Format

The value returned for this field is 2h, indicating that the data found is in accordance with the SCSI standard.

Byte 04 – Additional Length

The value returned for this field is 35h, indicating that there are 53 bytes of additional Inquiry data available to be returned.

Byte 07, Bit 7 – RelAdr (Relative Address)

The value returned for this field is 0, indicating that the tape drive does not support relative addressing.

Byte 07, Bit 6 – WBus32

The value returned for this field is 1, indicating that the tape drive supports 32-bit-wide bus transfers.

Byte 07, Bit 5 – WBus16

The value returned for this field is 1, indicating that the tape drive supports 16-bit-wide bus transfers.

Byte 07, Bit 4 – Sync

The value returned for this field is 0, indicating that the tape drive does not support synchronous data transfer.

Byte 07, Bit 3 – Linked

The value returned for this field is 0, indicating that the tape drive does not support linked commands.

Byte 07, Bit 1 – CmdQue

The value returned for this field is 0, indicating that the tape drive does not support tag command queuing.

Byte 07, Bit 0 – SftRe (Soft Reset)

The value returned for this bit is 0, which indicates that the tape drive does not support the soft reset alternative in response to a reset condition.

Bytes 08 through 15 – Vendor Identification

This field contains the ASCII representation of “HP”, followed by six spaces.

Bytes 16 through 31 – Product Identification

This field contains the ASCSII representation of “Ultrium 3-SCSI.”

Bytes 32 through 35 – Product Revision Level

This field contains the ASCII representation of a decimal number indicating the current revision level of the tape drive (for example, “0001” or other Tandberg Data revision levels).

Bytes 36 through 57 – Reserved

Supported Vital Product Data Page (Page Code 00h)

The tape drive returns the Supported Vital Product Data page when the EVPD bit in the command CDB is 1 and the Page Code is 00h.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	Page Code							
02	Reserved							
03	Page Length							
04	First Page Code Supported							
05	Second Page Code Supported							
06	Third Page Code Supported							
07	Fourth Page Code Supported							

Byte 00, Bits 7 through 5 – Peripheral Qualifier

The Peripheral Qualifier indicates whether a device of the type specified in Peripheral Device Type field is currently connected to the specified logical unit (LUN), as follows:

000b	The specified device type is currently connected to this logical unit.
011b	The LUN is invalid (the LUN in the CDB or in the Identify message was not 0).

Byte 00, Bits 4 through 0 – Peripheral Device Type

The Peripheral Device Type identifies the device currently connected to the specified logical unit (LUN), as follows:

00001b	The device (the tape drive) is a sequential access device.
11111b	The device type is unknown or there is no device type (the LUN in the CDB or in the Identify message was not 0).

Byte 01 – Page Code

The Page Code for the Vital Product Data page is 00h.

Byte 03 – Page Length

The value returned for this field is 04h, indicating that four bytes of additional information are available, excluding this byte.

Byte 04 – First Page Code Supported

The value for this field is 00h, indicating support for the Vital Product Data page.

Byte 05 – Second Page Code Supported

The value returned for this field is 80h, indicating support for the Unit Serial Number page.

Byte 06 – Third Page Code Supported

The value returned for this field is 83, indicating support for the Device Identification page.

Byte 07 – Fourth Page Code Supported

The value returned for this field is C0h, indicating support for a vendor-specific Inquiry page defined as the Original Inquiry Data page.

Unit Serial Number Page (Page Code 80h)

The tape drive returns the Unit Serial Number page when the EVPD bit in the CDB is 1 and the Page Code is 80h.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	Page Code							
02	Reserved							
03	Page Length							
04 ⋮ 13	Unit Serial Number							

Byte 00, Bits 7 through 5 – Peripheral Qualifier

The Peripheral Qualifier indicates whether a device of the type specified in Peripheral Device Type field is currently connected to the specified logical unit (LUN), as follows:

000b	The specified device type is currently connected to this logical unit.
011b	The LUN is invalid (the LUN in the CDB or in the Identify message was not 0).

Byte 00, Bits 4 through 0 – Peripheral Device Type

The Peripheral Device Type identifies the device currently connected to the specified logical unit (LUN), as follows:

00001b	The device (the tape drive) is a sequential access device.
11111b	The device type is unknown or there is no device type (the LUN in the CDB or in the Identify message was not 0).

Byte 03 – Page Length

The value returned for this field is 0Ah, indicating that there are 10 bytes of additional information available, excluding this byte.

Bytes 04 through 13 – Unit Serial Number

This field contains the ASCII representation of the tape drive's ten-digit serial number in the format *hhhhhhhhhh*, where *h* is a hexadecimal digit (for example, 0000012ABC).

Device Identification Page (Page Code 83h)

The Device Identification page allows the tape drive to report its device identifiers, including its product name and serial number. The tape drive returns the Device Identification page when the EVPD bit in the CDB is 1 and the Page Code is 83h.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	Page Code							
02	Reserved							
03	Page Length (28h)							
04	Reserved				Code Set			
05	Reserved				Identifier Type			
06	Reserved							
07	Identifier Length (22h)							
08 ⋮ 41	(MSB) Device Identifier 1 (LSB)							

Byte 00, Bits 7 through 5 – Peripheral Qualifier

The Peripheral Qualifier indicates whether a device of the type specified in Peripheral Device Type field is currently connected to the specified logical unit (LUN), as follows:

000b	The specified device type is currently connected to this logical unit.
011b	The LUN is invalid (the LUN in the CDB or in the Identify message was not 0).

Byte 00, Bits 4 through 0 – Peripheral Device Type

The Peripheral Device Type identifies the device currently connected to the specified logical unit (LUN), as follows:

00001b	The device (the tape drive) is a sequential access device.
11111b	The device type is unknown or there is no device type (the LUN in the CDB or in the Identify message was not 0).

Byte 01 – Page Code

The value for this field is 83h, identifying the current page as the Device Identification page.

Byte 03 – Page Length

The value returned for this field is 26h, indicating that there are 38 bytes of additional information available, excluding this byte.

Byte 04, Bits 3 through 0 – Code Set

The value returned for this field is 02h, which indicates that the Device Identifier 1 field contains ASCII data**.**

Byte 05, Bits 3 through 0 – Identifier Type

The value returned for this field is 1h, indicating that the uniqueness of the identifier field is the responsibility of the company identified in the Vendor Identification field of Device Identifier 1 (bytes 08 through 15).

Byte 07 – Identifier Length

The value returned for this field is 22h, which indicates that the length of the Device Identifier 1 field is 34 bytes, excluding this byte.

Byte 08 through Byte 43 – Device Identifier 1

This field contains the Device Identifier for the tape drive, as follows:

- **Bytes 08 through 15 – Vendor Identification –** The ASCII representation of "HP", followed by six ASCII space characters.
- **Bytes 16 through 31 – Product Identification –** This field contains the ASCII representation of "Ultrium 3-SCSI."
- **Bytes 32 through 41 – Unit Serial Number –** This field contains the ASCII representation of the tape drive's serial number in the format *aaaaaaaaaa*, where *a* is an alphanumeric character (for example: 08a3f4T111).

Exceptions and Error Conditions

The tape drive returns Good status in response to an INQUIRY command, even if it is not ready to accept commands. If the tape drive receives an INQUIRY command from an initiator that has a pending Unit Attention condition, the tape drive responds to the command and does not clear the Unit Attention condition.

Table 5-2 lists exceptions and error conditions that cause the tape drive to return Check Condition status for the INQUIRY command.

Table 5-4 *REQUEST SENSE data for INQUIRY command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Explanation
05h	24h	00h	**Illegal Request.** Invalid field in the CDB.

LOAD/UNLOAD (1Bh)

The LOAD/UNLOAD command causes the tape drive to load or unload the data cartridge.

During a load operation, the tape drive performs the following actions:

1. It loads the tape into the tape path. (If the tape is already loaded, the tape drive takes no action.)

   Note: The cartridge must be fully inserted into the tape drive when you issue the LOAD command. The LOAD command does not pull the cartridge into the tape drive.

2. It reads the logical format record at the beginning of the tape or determines that the tape is blank.

3. It positions the tape at the logical beginning of tape (LBOT).

4. It goes to the tape ready, idle state.

5. The tape drive returns Check Condition status with the sense key set to Unit Attention (6h) to all initiators on the bus.

When the tape drive receives tape motion commands during a load operation, it queues (holds) one tape motion command per initiator (and disconnects, if allowed) until the load operation is complete. Then it attempts to execute the queued command.

Note: If another initiator has reserved the tape drive for its exclusive use, the tape drive returns Reservation Conflict status to the initiator issuing the current LOAD/UNLOAD command.

During an unload operation, the tape drive performs the following actions:

1. It completes any command or operation in progress.

2. If necessary, it writes any buffered information to tape, then writes an EOD mark to indicate the end of data.

3. It writes the updated logical format record at the beginning of the tape.

4. It rewinds the tape to the physical beginning of tape (PBOT) and unloads the tape from the tape path.

5. If the Prevent bit in the PREVENT MEDIUM REMOVAL command is not set to 1 (see PREVENT/ALLOW MEDIUM REMOVAL (1Eh) on page 232), it ejects the data cartridge.

6. After completing the unload operation, the tape drive returns Check Condition status with the sense key set to Not Ready (2h) to all subsequent commands that require tape motion.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	1	1	0	1	1
01	Reserved							Immed
02	Reserved							
03								
04	Reserved					EOT	Re-Ten	Load
05	Control							

CDB Field Definitions

Byte 01, Bit 1 – Immed

This field specifies when the tape drive returns command status to the initiator:

0	Status is reported when the load/unload operation is complete.
1	Status is reported when the command is initiated by the tape drive.

If the buffer contains data from a previous WRITE command, the tape drive does not execute the command until the data in the buffer is written to the tape and an EOD mark appended. The tape drive then performs the load or unload operation as follows:

- If the Immed bit is set to 1, the tape drive returns Good status when the write operation has been completed successfully. It then performs the load or unload operation.

- If the Immed bit is set to 0, the tape drive returns status when the load or unload operation is complete.

If an error occurs during the writing of the data from the buffer to the tape, the tape drive returns Check Condition status. The load or unload operation is not performed.

Byte 04, Bit 2 – EOT

The tape drive ignores this bit.

Byte 04, Bit 1 – Re-Ten

The tape drive ignores this bit.

Byte 04, Bit 0 – Load

This field specifies which operation, load or unload, is to be performed:

0	Perform an unload operation
1	Perform a load operation

Table 5-5 indicates what action occurs based on the setting of the Load bit and the status of the data cartridge.

Table 5-5 *Action occurring based on the Load bit and data cartridge status*

If the Load bit is set to...	And the data cartridge is...	The following action occurs...
0	Out	No action.
1	Out	Check Condition status is returned with the sense key set to Not Ready (2h).
0	In	The data cartridge is unloaded.[a] If there is data in the write buffer, the data is written to tape. Then, the tape is rewound to PBOT and unloaded from the tape path, and the data cartridge is ejected from the tape drive.
1	In	The data cartridge is loaded and positioned at LBOT. If the data cartridge is already loaded and there is data in the buffer, the data is written to the tape before the operation is performed.

[a] The unload operation is performed even if the PREVENT/ALLOW MEDIUM REMOVAL command was issued with the Prevent bit set to 1; however, the data cartridge is not ejected from the tape drive.

Exceptions and Error Conditions

Table 5-2 lists exceptions and error conditions that cause the tape drive to return Check Condition status for the LOAD/UNLOAD command.

Table 5-6 *REQUEST SENSE data for LOAD/UNLOAD command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Explanation
02h	04h	01h	**Not Ready.** Tape drive is not ready, but is in process of becoming ready (rewinding or loading tape).
02h	04h	02h	**Not Ready.** Tape drive is not ready because it is in the process of ejecting a cartridge.
02h	04h	03h	**Not Ready.** The tape drive is not ready because it needs manual intervention.
02h	3Ah	00h	**Not Ready.** Tape drive is not ready. Command requires a tape, and no tape is present.
03h	30h	02h	**Medium Error.** The tape format is incompatible with the tape drive hardware or microcode.
03h	31h	01h	**Medium Error.** The tape format is corrupted.
03h	50h	00h	**Medium Error.** The tape drive could not locate a valid splice location on the tape. The tape is not located at a valid write position or the tape drive could not locate the valid write position.
04h	15h	01h	**Hardware Error.** The tape drive cannot position the tape correctly.
04h	53h	00h	**Hardware Error.** The load or eject operation failed.
04h	53h	01h	**Hardware Error.** The unload operation failed.
05h	24h	00h	**Illegal Request.** Invalid field in the CDB.
06h	30h	00h	**Unit Attention.** Incompatible media was rejected after the cartridge was inserted.

LOCATE (2Bh)

The LOCATE command, in conjunction with the READ POSITION (34h) command, allows you to position the tape at a specified logical block address. During forward and backward locate operations, the tape drive moves the tape at its highest speed.

Unlike space operations, locate operations do not detect filemarks and setmarks and do not return Check Condition status when these elements are encountered.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	1	0	1	0	1	1
01	Reserved					BT	CP (0)	Immed
02	Reserved							
03 ⋮ 06	(MSB)	Block Address						(LSB)
07	Reserved							
08	Reserved							
09	Control							

Using the LOCATE Command

To use the LOCATE command, follow these steps:

1. Determine the tape drive's current location by issuing a READ POSITION command (see READ POSITION (34h) on page 241).
2. In the initiator's memory, save the information returned for the First Block Location field (bytes 04 through 07) of the READ POSITION data.
3. Continue reading or writing data as required.
4. When you want to return to the previous location, issue a LOCATE command and specify the saved address in the Block Address field (bytes 03 through 06).

Note: If the tape drive receives a LOCATE command after a WRITE (0Ah) or WRITE FILEMARKS (10h) command, it writes any buffered data, filemarks, or setmarks to the tape before performing the locate operation.

If an error occurs while the buffered data is being written, the tape drive returns Check Condition status and the locate operation is not performed.

CDB Field Definitions

Byte 01, Bit 2 – BT (Block Type)

This field specifies the type of block number the tape drive returns to the initiator in the Block Address field (bytes 03 through 06). The tape drive ignores this field.

Byte 01, Bit 1 – CP (Change Partitions)

This field should always be 0.

Byte 01, Bit 0 – Immed

This field specifies when the tape drive returns command status to the initiator, as follows:

0	Status is reported when the LOCATE command is completed.
1	Status is reported when the LOCATE command is initiated by the tape drive.

If the buffer contains data from a previous WRITE command, the tape drive does not execute the LOCATE command until the data in the buffer is written to the tape and an EOD mark is appended. The tape drive then performs the erase operation as follows:

- **If the Immed bit is set to 1,** the tape drive returns Good status and performs the locate operation.
- **If the Immed bit is set to 0**, the tape drive returns status when the locate operation is complete.

Bytes 03 through 06 – Block Address

This field specifies the address of the block that the tape drive is to locate, as follows:

- If the BT bit is 0, this field contains the Logical Block Address that the drive should locate. The value for this field is the value previously returned in the First Block Address field in the READ POSITION data.
- If the BT bit is 1, this field contains the Physical Block Address that the drive should locate. The value for this field is the value previously returned in the First Block Address field in the READ POSITION data. The one exception is that a value of 0 may be used to locate the logical beginning of tape (LBOT).

! Important Be aware that using physical block addresses provide only approximate positions on the tape and have no relationship to data.

Exceptions and Error Conditions

Table 5-2 lists exceptions and error conditions that cause the tape drive to return Check Condition status for the LOCATE command.

Table 5-7 *REQUEST SENSE data for LOCATE command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Explanation
02h	04h	01h	**Not Ready.** Tape drive is not ready, but is in process of becoming ready (rewinding or loading tape).
02h	04h	03h	**Not Ready.** The tape drive is not ready because it needs manual intervention.
02h	3Ah	00h	**Not Ready.** Tape drive is not ready. Command requires a tape, and no tape is present.
03h	00h	02h	**Medium Error.** The tape drive encounters the physical end of tape (PEOT) before completing the operation. When the LOCATE command terminates, the logical position is the last logical position the tape drive detected on tape.
03h	14h	00h	**Medium Error.** The tape drive cannot perform the locate operation because it cannot read data from the tape.
03h	30h	02h	**Medium Error.** The tape format is incompatible with the tape drive hardware or microcode.
03h	31h	01h	**Medium Error.** The tape format is corrupted.
04h	15h	01h	**Hardware Error.** The tape drive cannot position the media correctly.
05h	24h	00h	**Illegal Request.** Invalid field in the CDB. This error is a result of the BT bit is set to 1.
06h	30h	00h	**Unit Attention.** Incompatible media was rejected after the cartridge was inserted.
08h	00h	05h	**Blank Check.** The tape drive encountered an EOD mark. When the LOCATE command terminates, the logical tape position is after the last recorded data block, filemark, or setmark. Issue a READ POSITION command to determine the exact location.

LOG SENSE (4Dh)

The LOG SENSE command enables you to retrieve statistical information about various tape drive parameter values. The tape drive maintains the following pages of parameters:

- Supported Pages page (00h)
- Write Error Counters page (02h)
- Read Error Counters page (03h)
- TapeAlert page (2Eh)
- Compression Statistics page (30h)

- Tape Capacity page (31h)

The LOG SENSE data returned by the tape drive consists of a four-byte Parameter List Header and a log page. Each log page contains log parameter data blocks that provide information about the parameters.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	1	0	0	1	1	0	1
01	Reserved						PPC	SP
02	PC		Page Code					
03	Reserved							
04								
05	(MSB)	Parameter Pointer						(LSB)
06								
07	(MSB)	Allocation Length						(LSB)
08								
09	Control							

CDB Field Definitions

Byte 01, Bit 1 – PPC (Parameter Pointer Control)

The PPC bit specifies the type of parameters being requested from the tape drive. This bit must be 0, which indicates that the tape drive should return all parameters for the specified log page, beginning with the parameter specified in the Parameter Pointer field (bytes 05 and 06).

Byte 01, Bit 0 – SP (Save Parameters)

The tape drive does not support the save parameters function. The value for this bit must be 0.

Byte 02, Bits 7 and 6 – PC (Page Control)

This field specifies the type of parameter values the tape drive returns. Table 5-8 lists the valid values for the PC field.

Table 5-8 *Valid values for the LOG SENSE Page Control (PC) field*

PC Value	Description
00b	Return the current threshold values for the parameters listed in the parameter list. These values are reset to their default settings after a power-on reset, SCSI bus reset, or Bus Device Reset message.
01b	Return the current cumulative values for the parameters listed in the parameter list. These values are the values that have accumulated since the last power-on reset, SCSI bus reset, or Bus Device Reset message. When a parameter reaches its maximum value, it is returned as all FFs. (For example, FFFFFFFFh is returned as the maximum value for a four-byte parameter.)
10b	Return the default threshold values. The default threshold values cannot be changed. The values returned represent the maximum values each parameter can obtain (all FFs).
11b	Return the default cumulative values. The default cumulative values cannot be changed. The values returned represent the values that each parameter is reset to (whether by power-on reset, SCSI bus reset, or Bus Device Reset message). The default cumulative value for all parameters is 0.

Byte 02, Bits 5 through 0 – Page Code

This field specifies which LOG SENSE page is being requested. The type of data returned for the page depends on the value specified for the PC bit. Table 5-9 lists the log pages supported by the tape drive.

Table 5-9 *Log pages supported by the tape drive*

Page Code	Description	Look here for information....
00h	**Supported Log Pages Page ODh** (13 bytes) Return the lists of pages supported by the LOG SENSE command.	page 193
02h	**Write Error Counters Page 40h** (64 bytes) Return log parameter data blocks for each write error counter.	page 194
03h	**Read Error Counters Page 40h** (64 bytes) Return log parameter data blocks for each read error counter.	page 194
2Eh	**Tape Alert Log Page 144h** (324 bytes) Return log parameter data blocks containing information from the tape drive's internal TapeAlert firmware. This firmware constantly monitors the tape drive and the tape for errors and potential difficulties. When a problem is detected, the tape drive sets a flag on this page to identify the type of problem detected.	page 195

Table 5-9 *Log pages supported by the tape drive*

Page Code	Description	Look here for information....
30h	**Tape Usage Log Page 60h** (96 bytes)	
31h	**Tape Capacity Log Page 28h** (40 bytes) Return log parameter data containing statistics about the data on the currently loaded data cartridge media.	page 198

Bytes 05 and 06 – Parameter Pointer

This field specifies the Parameter Code of the first parameter to be returned for the requested page. Valid values for this field are 00h through the highest supported Parameter Code for the specified page. As long as the value in the Allocation Length field is large enough, the tape drive returns all parameters with a Parameter Code greater than or equal to the code specified in this field.

The parameters are returned in Parameter Code order (unsigned). If the parameter specified does not exist, the tape drive returns the first available parameter following the specified parameter.

Notes:

- If you set the Page Code field to 00h (Supported Log Pages page), the Parameter Pointer field is ignored.
- If the value for the Parameter Pointer is greater than the Parameter Code for any of the parameters, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h), the ASC set to 24h, and the ASCQ set to 00.

Bytes 07 and 08 – Allocation Length

This field specifies the maximum number of bytes allocated by the initiator to receive the data transferred by the tape drive. Valid values are from 0 to FFFFh.

Table 5-10 lists the minimum Allocation Length required to return each supported page. Each LOG SENSE command can return only one log page.

Note: It is not an error to specify a value for the Allocation Length field that would truncate the information on one of the pages.

Table 5-10 *Minimum Allocation Length required for each supported log page*

Page Code	Description	Minimum Allocation Length
00h	Supported Log Pages page	0Dh (13 bytes)
02h	Write Error Counters page	2Ch (44 bytes)
03h	Read Error Counters page	2Ch (44 bytes)
2Eh	TapeAlert page	144h (324 bytes)

***Table 5-10** Minimum Allocation Length required for each supported log page*

Page Code	Description	Minimum Allocation Length
30h	Compression Statistics page	2Ch (44 bytes)
31h	Tape Capacity page	24h (36 bytes)
36h	Environmental Counter page	33h (53 bytes)
37h	Tape Usage page	FCh (252 bytes)
39h	Tape Last FSC page	72h (114 bytes)
3Ch	Drive Statistics page	0AEh (174 bytes)

What the Tape Drive Returns

This section describes the log page format and the log pages supported by the tape drive. The LOG SENSE command returns the single log page specified in the Page Code field of the CDB.

Each log page begins with a four-byte Parameter List Header (bytes 00 through 03), followed by zero or more variable-length log parameters defined for that page. The Parameter List Header specifies the page code for the log parameter data being returned and indicates the total length of the data to follow.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	Page Code					
01	Reserved							
02	(MSB)		Page Length					(LSB)
03								

Byte 00, Bits 5 through 0 – Page Code

This field identifies the type of LOG SENSE data being returned by the tape drive. The value returned for this field matches the Page Code specified in the CDB. Table 5-9 on page 188 lists the log pages supported by the tape drive.

Bytes 02 and 03 – Page Length

This field indicates the total number of bytes that will follow this byte if the Allocation Length specified in the CDB is sufficient. The value returned for this field depends on the value specified for the Page Code and the Parameter Pointer in the CDB. Table 5-10 on page 189 lists the maximum Page Length of each supported page.

Log Parameter Format

The tape drive returns the log parameters for the specified page immediately after it returns the Parameter List Header. For each parameter on the page, the tape drive returns a data block that includes four bytes of descriptive information and a variable-length parameter value. The total number of bytes returned for each parameter is equal to the value in the Parameter Length field plus four bytes for the Parameter List Header.

The tape drive returns the log parameter data blocks for the specified LOG SENSE page in Parameter Code order. The code for the first parameter will be equal to or greater than the value specified for the Parameter Pointer field in the CDB.

Byte \ Bit	7	6	5	4	3	2	1	0
00	(MSB)			Parameter Code				(LSB)
01								
02	DU	DS	TSD	ETC	TMC		RSVD	LP
03	Parameter Length							
04	(MSB)			Parameter Value				(LSB)
⋮								
nn								

Bytes 00 and 01 – Parameter Code

This field identifies the code of the parameter for which the tape drive is returning a value. See the following sections for a list of the parameter codes for each page.

Byte 02, Bit 7 – DU (Disable Update)

This field indicates whether updates to the current cumulative value for this parameter are enabled or disabled, as follows:

0	The tape drive can update the current cumulative value, so comparisons between the current cumulative value and the threshold value occur normally.
1	The tape drive will not update the current cumulative value, so threshold conditions will not be met for this parameter.

Byte 02, Bit 6 – DS (Disable Save)

The tape drive always returns 1 for this bit, indicating that it does not support the saving of log parameters.

Byte 02, Bit 5 – TSD (Target Save Disable)

The value for the Target Save Disable bit indicates whether the tape drive provides a self-defined method for saving log parameters, as follows:

0	The tape drive provides a self-defined method for saving the current cumulative value for this counter. The counter is not reset when the tape drive is reset.
1	The tape drive does not support saving the current cumulative value for this counter. The counter is reset when the tape drive is reset.

Byte 02, Bit 4 – ETC (Enable Threshold Comparison)

This field indicates whether threshold comparisons are enabled or disabled for this parameter:

0	Threshold comparisons are disabled for this parameter.
1	Threshold comparisons are performed on this parameter.

When threshold comparisons are enabled (and the DU bit is 0), the tape drive compares the current cumulative value to the threshold value for the parameter. When the conditions specified by the TMC bit are met, the tape drive returns Check Condition status with the sense key set to Unit Attention (6h), the ASC and ASCQ set to 5Bh and 01h.

Threshold comparisons are made when the cumulative value is updated.

Byte 02, Bits 3 and 2 – TMC (Threshold Met Criteria)

This field indicates the condition under which the tape drive generated the Unit Attention (6h) sense key. Table 5-11 lists the valid values for the TMC field.

Table 5-11 *Valid values for the LOG SENSE Threshold Met Criteria (TMC) field*

TMC Value	Description
00b	Unit Attention resulted when the cumulative value was updated
01b	Unit Attention resulted when the updated cumulative value equaled the threshold value
10b	Unit Attention resulted when the updated cumulative value did not equal to the threshold value
11b	Unit Attention resulted when the updated cumulative value was greater than the threshold value

Note: If you want the tape drive to return Unit Attention to notify you about changes to the parameters, first issue a MODE SELECT command and send the Control Mode page (Page Code=0Ah) with the Report Log Exception Condition (RLEC) bit set to 1. Refer to MODE SELECT (15h) on page 199 for more information.

Byte 02, Bit 0 – LP (List Parameter)

The value for this bit is always 0, indicating that the tape drive does not support List Parameters.

Byte 03 – Parameter Length

This field indicates the length of the threshold or cumulative value in bytes.

Bytes 04 to *nn* – Parameter Value

This field contains either a threshold value or a cumulative value for the parameter indicated by the Parameter Code field, depending on what you specified for the PC bit in the CDB.

Supported Log Pages Page (Page Code 00h)

The tape drive returns the Supported Log Pages page when the Page Code in the CDB is 00h. The value in the Page Length field (bytes 2 and 3) of the Parameter List Header for this page is 09h (9 bytes).

Unlike other LOG SENSE pages, no parameter information is returned on this page. Instead, the Supported Log Pages page lists the page codes for the LOG SENSE pages supported by the tape drive. The page codes are listed in ascending order, as follows:

Byte \ Bit	7	6	5	4	3	2	1	0
00	Supported Log Pages (00h)							
01	Write Error Counters Page (Page Code 02h)							
02	Read Error Counters Page (Page Code 03h)							
03	Sequential Access Device Log (Page Code 0Ch)							
04	Tape Alert Page (Page Code 2Eh)							
05	Tape Usage Page (Page Code 30h)							
06	Tape Capacity Log (Page Code 31h)							

Write Error Counters Page (Page Code 02h)
Read Error Counters Page (Page Code 03h)

Setting the Page Code in the CDB to 02h (Write Error Counters page) or 03h (Read Error Counters page) causes the tape drive to return the Write Error Counters page or the Read Error Counters page, respectively.

Table 5-12 lists the parameters used to return information about the write or read error on the Write Error Counters page and the Read Error Counters page.

Table 5-12 *Parameters returned on the LOG SENSE Write Error and Read Error Counters pages*

Parameter Code	Parameter Name	Description	Length (bytes)
0000h	Errors corrected without substantial delay	Total number of errors corrected without substantial delay	4
0001h	Errors corrected with possible delays	Total number of errors corrected using retries	4
0002h	Total Rewrites	The number of physical blocks the tape drive rewrote because they contained errors detected during check-after-write operations.	4
	Total Rereads	Indicates the number of times the tape drive moved the tape backward to reread a portion of tape because a block was missed.	4
0003h	Total Errors Corrected	**Write error.** Contains the same value as the Total Rewrites counter.	4
		Read error. Indicates the total number of blocks the tape drive recovered either by using the ECC algorithm or by successfully rereading the block.	4
0004h	Total Times Errors Processed	**Write error.** Always contains 0 since write errors are rewritten.	4
		Read error. The number of blocks corrected by ECC.	4
0005h	Total Bytes Processed	**Write error.** The number of bytes successfully written to the tape. This counter only includes user data bytes. Rewritten data is not counted.	8
		Read error. The number of user bytes read from tape and transferred to the initiator.	8
0006h	Total Unrecoverable Errors	**Write error.** The number of times the tape drive could not write a block to the tape after all retries.	4
		Read error. The number of times a block could not be read from tape after all retries.	4

TapeAlert Page (Page Code 2Eh)

The tape drive's internal TapeAlert firmware constantly monitors the tape drive and the tape for errors and potential difficulties. Any problems identified are flagged on the TapeAlert page. There are two methods of accessing this information:

- If TapeAlert is enabled using the MODE SELECT command, the tape drive returns a Recovered Error message to the initiator on the next SCSI command whenever one or more TapeAlert flags are set. A pending Recovered Error will be returned on the first successful SCSI command after the TapeAlert flag is set. The TapeAlert log page should be read immediately after the Recovered Error message is received.

  Note: The command which receives the Recovered Error message will have executed correctly and should not be reissued by the initiator.

- The host software can periodically read the TapeAlert log page to determine if any new flags have been set. If this method is used, the initiator should read the log page whenever any of the following occur:

  - Immediately after a SCSI Check Condition status followed by a REQUEST SENSE.
  - At the end of each tape when a job spans multiple tapes. If the data cartridge will be ejected, then the TapeAlert page must be read before the tape is unloaded.
  - At the completion of an operation.
  - Before a tape is unloaded.
  - At some regularly scheduled interval (for example, once a minute).

Setting the Page Code in the CDB to 2Eh causes the tape drive to return the TapeAlert log page. The value in the Page Length field (bytes 2 and 3) of the Parameter List Header for this page is 0140h (320 bytes).

Table 5-13 lists the TapeAlert flags on the TapeAlert page. Each TapeAlert flag includes four bytes of descriptive information (see page 191), followed by a one-byte parameter value for the flag. Bit 0 of the parameter value contains the value for the flag, as follows:

0	The flag is not currently set.
1	The flag is currently set.

The remaining 7 bits of the flag are not used.

Notes:

- Issuing a LOG SENSE command to return the TapeAlert page resets all of the flags to 0. The flags are also reset whenever the tape drive is reset or when the condition indicated by the flag is corrected.

- Although the tape drive only supports the TapeAlert flags listed in Table 5-13, it returns all 64 flags defined in the TapeAlert standard. Unused flags are set to 0

To contact Tandberg Data Technical Support, go to page ii.

Note: Parameters 1h through 40h are returned in the Log Sense response. Any parameter which is returned but is not in the table is not applicable to the QuikStation tape TapeAlert.

Table 5-13 *Parameters returned on the LOG SENSE TapeAlert page*

Parameter	Flag name	Type[a]	Description
03h	Hard Error	W	A hard read/write error has occurred. The current operation has stopped because the tape drive cannot correct an error that occurred while the tape drive was reading or writing data.
04h	Media	C	Media performance is severely degraded. Your data is at risk. To safeguard the data on this tape, do the following: ▸ Copy any data you want to preserve to another tape. ▸ Do not use this tape again. Restart the current operation using a different tape.
05h	Read Failure	C	The tape drive can no longer read data from the tape. Either the tape is faulty or the tape drive is not operating correctly. ▸ Try reading data from a known good tape. If you can read this tape, replace the damaged tape. ▸ If the problem persists, contact Technical Support.
06h	Write Failure	C	The tape drive can no longer write data to the tape. Either the tape is faulty or the tape drive is not operating correctly. ▸ Try writing data to a known good tape. If you can write to this tape, replace the faulty tape. ▸ If the problem persists, contact Technical Support).
08h	Not Data Grade	W	The tape drive cannot read the MRS stripes on the tape. The tape is not data-grade. Any data you back up onto the tape is at risk. Replace the cartridge with one containing data-grade tape.
09h	Write Protect	C	The initiator attempted to write to a write-protected data cartridge. Write-enable the cartridge or use another cartridge.
0Ah	No Removal	I	A data cartridge unload operation was attempted while the initiator was preventing media removal.
0Bh	Cleaning Media	I	A cleaning cartridge is currently in the tape drive. If you want to back up or restore, insert a data cartridge.
0Ch	Unsupported Format	I	The loaded tape contains data in an unsupported format.
0Dh	Snapped Tape	C	The data cartridge in the tape drive contains a broken tape. ▸ Discard the data cartridge. ▸ Restart the current operation with a different tape.

Table 5-13 *Parameters returned on the LOG SENSE TapeAlert page (continued)*

Parameter	Flag name	Type[a]	Description
10h	Forced Eject	C	The user ejected the cartridge while the tape drive was in the process of reading or writing data.
12h	Tape Directory Corrupted	W	The logical format of the tape has been corrupted, rendering the tape unusable. Reformat the tape.
13h	Nearing Media Life	I	The data cartridge currently in the tape drive is approaching the end of its usable life.
14h	Clean Now	C	The tape drive needs cleaning. ▸ If the tape drive is not currently in use, eject any data cartridge and insert a cleaning cartridge to clean the tape drive. ▸ If the tape drive is in use, wait until the current operation is complete, then insert a cleaning cartridge to clean the tape drive.
15h	Clean Periodic	W	The tape drive needs to be cleaned at the next opportunity.
16h	Expired Cleaning Media	C	The cleaning cartridge that was inserted into the tape drive is used up. Use a new cleaning cartridge to clean the tape drive.
1Fh	Hardware B	C	The tape drive has a problem that is not read/write related. ▸ Turn the tape drive off and then on again. ▸ Restart the operation. ▸ If the problem persists, contact Technical Support.
20h	Interface	W	There is a problem in the SCSI interface between the initiator and the tape drive. ▸ Check all of the SCSI cables and connections. ▸ Restart the operation.
22h	Download Fail	W	The last attempt to download new firmware has failed. Obtain the correct firmware and try again.
24h	Drive Temperature	W	The tape drive's internal temperature at the tape path has exceeded 47° C (117° F).

[a] I = Informational suggestion to user.
W = Warning. Remedial action is advised. Performance of data may be at risk.
C = Critical. Immediate remedial action is required.

Tape Usage (Page Code 30h)

Setting the Page Code in the CDB to 30h causes the tape drive to return the Tape Usage log page.

Table 5-14 lists the parameters used to provide cumulative compression statistics for tape currently loaded in the tape drive.

Table 5-14 *Parameters returned on the LOG SENSE Tape Usage page*

Parameter Code	Description	Length (bytes)
1	Thread Count	4
2	Total Data Sets Written	8
3	Total Write Retries	4
4	Total Unrecovered Write Errors	2
5	Total Suspended Writes	2
6	Total Fatal Suspended Writes	2
7	Total Data Sets Read	8
8	Total Read Retries	4
9	Total Unrecovered Read Errors	2

Tape Capacity Page (Page Code 31h)

Setting the Page Code in the CDB to 31h causes the tape drive to return the Tape Capacity log page.

Table 5-15 lists the parameters used to provide capacity information about the partitions on the tape currently loaded in the tape drive.

Table 5-15 *Parameters returned on the LOG SENSE Tape Capacity page*

Parameter Code	Parameter Name	Description	Length (bytes)
1h	Main Partition Remaining Capacity	The number of megabytes of data that might be written between the current location and the EOP.	4
2h	Alternate Partition Remaining Capacity	Not applicable.	4
3h	Main Partition Maximum Capacity	The maximum number of megabytes of data that might be written in the main partition.	4
4h	Alternate Partition Maximum Capacity	Not applicable.	4

Exceptions and Error Conditions

Table 5-16 lists the exceptions and error conditions that cause the tape drive to return Check Condition status for the LOG SENSE command.

Table 5-16 *REQUEST SENSE data for LOG SENSE command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Explanation
02h	3Ah	00h	**Not Ready.** Tape drive is not ready. Command requires a tape, and no tape is present.
5h	24h	00h	**Illegal Request.** Invalid field in CDB. This error is a result of any of the following: ▸ The PPC bit is not 0. ▸ The SP bit is set to 1. ▸ The Page Code field is not 00h, 02h, or 03h. ▸ The Parameter Pointer is an invalid value greater than 06h.

MODE SELECT (15h)

The MODE SELECT command allows the initiator to specify medium and device parameters. These parameters apply to all initiators in a multi-initiator environment. The parameters transferred from the initiator after the CDB are structured as pages of related parameters (SCSI standard format). The parameters are transferred in the following order:

- Parameter List Header
- Block Descriptor (optional)
- One or more available pages of related parameters

Unless otherwise noted, the parameters set using this command return to their default values whenever the tape drive is power-cycled or reset (SCSI bus reset or Bus Device Reset).

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	0	1
01	Reserved			PF	Reserved			SP
02	Reserved							
03								
04	Parameter List Length							
05	Control							

CDB Field Definitions

Byte 01, Bit 4 – PF (Page Format)

The tape drive ignores this field. All of the parameters use standard page format.

Byte 01, Bit 0 – SP (Saved Page)

The tape drive does not support the saved page function. The valid value for this bit is 0.

Byte 04 – Parameter List Length

This field indicates the total number of bytes to be transferred from the initiator to the tape drive. All parameters after the Block Descriptor are transferred as pages of parameters. There is no specific order for the parameter pages.

To determine the Parameter List Length, total the number of bytes contained in the Parameter List Header, the Block Descriptor (if you are sending it), and all of the parameter pages you are sending. The maximum value you can specify is FFh. Table 5-17 lists the lengths of the Parameter List Header, Block Descriptor, and each supported mode page.

Note: When the value for the Parameter List Length is 0, no data is transferred from the initiator. A value of 0 is not an error.

***Table 5-17** MODE SELECT parameter page lengths*

Parameter	Length
Parameter List Header	04h (4 bytes)
Block Descriptor	08h (8 bytes)
Read-Write Recovery page (Page Code 01h)	0Ch (12 bytes)
Disconnect-Reconnect page (Page Code 02h)	10h (16 bytes)
Data Compression page (Page Code 0Fh)	10h (16 bytes)
Device Configuration page (Page Code 10h)	10h (16 bytes)
TapeAlert page (Page Code 1Ch)	0Ch (12 bytes)

Restrictions for sending MODE SELECT parameters

- For data transfers greater than 0 bytes, the entire Parameter List Header must be transferred before the Block Descriptor or any parameter page or vendor-unique parameters.
- The Parameter List Header, Block Descriptor, and any parameter pages must be transferred in their entirety; partial transfers of these data segments are not allowed.

Note: Any value for the Parameter List Length that causes the Parameter List Header, Block Descriptor, or one of the parameter pages to be truncated will terminate the command with Check Condition status. The sense key will be set to Illegal Request and the Additional Sense Code will be set to Parameter List Length Error.

Mode Parameter Data

With each MODE SELECT CDB, you send a parameter list for each page on which you are changing values. Each parameter list begins with a Parameter List Header that identifies the parameter page being sent and indicates the number of bytes that follow the header as mode parameters. Immediately following the Parameter List Header is an optional Block Descriptor, followed by the list of values for each parameter on the page that you want to change.

Note: The total number of bytes in the parameter list equals the Page Length of the parameter page, plus four bytes for the Parameter List Header. The sum of the bytes in all the parameter lists must equal the value specified for the Parameter List Length in the CDB.

Parameter List Header

Each parameter list page begins with a four-byte Parameter List Header. The Parameter List Header is followed by the parameters for the specified page.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Reserved							
01								
02	RSVD	Buffered Mode			Speed			
03	Block Descriptor Length							

Byte 02, Bits 6 through 4 – Buffered Mode

This field specifies the data transfer mode to be used by the tape drive. The tape drive supports two data transfer modes:

000b	Unbuffered mode
001b	Buffered mode (power-on default)

In buffered mode, status is returned when the last block of data has been transferred to the tape drive's buffer. See WRITE (0Ah) on page 265 for more information about how data is buffered.

In unbuffered mode, status is returned only after the data has actually been written to the tape.

Byte 02, Bits 3 through 0 – Speed

The tape drive operates as a variable-speed device, where the tape drive automatically determines the optimum speed required. The valid value for this field is 0.

Byte 03 – Block Descriptor Length

This field specifies the length of the Block Descriptor in bytes, as follows:

00h	No Block Descriptor is included.
08h	An 8-byte Block Descriptor is included.

Note: The tape drive does not support multiple block descriptors.

Block Descriptor

The optional Block Descriptor defines the data format and other format characteristics to be used by the tape drive when it writes data.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Density Code							
01	(MSB)			Number of Blocks				(LSB)
02								
03								
04	Reserved							
05	(MSB)			Block Length				(LSB)
06								
07								

Byte 00 – Density Code

The Density Code specifies the format the tape drive will use to write data.

Bytes 01 through 03 – Number of Blocks

The tape drive ignores this field in the MODE SELECT data.

Bytes 05 through 07 – Block Length

This field indicates the length of each logical block, in bytes, when the Fixed bit is set for the READ, VERIFY, and WRITE commands. The default Block Length is 3C000h (245,760 bytes= 240 KB). Valid values for this field are from 0h to 3C000h (see page 241 for additional information).

- When the Block Length is non-zero, fixed-length block operations are allowed. For fixed-length blocks, only block sizes that are evenly divisible by four (that is, they end on a 4-byte boundary) are valid. A block length of 0 is invalid for fixed-length blocks.
- When the Block Length is 0, only variable-length block operations are allowed.

Note: If the Block Length is 0, the SILI bit in the READ command suppresses illegal length indications for both underlength and overlength reads. If the Block Length is non-zero, the SILI bit of the READ command suppresses illegal length indications only for blocks shorter than requested. See page 234 for more information.

Read-Write Error Recovery Page (Page Code 01h)

The Read-Write Error Recovery page specifies error recovery parameters used during read or write operations.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	Reserved		TB	RSVD	EER	PER	DTE	DCR
03	Read Retry Count							
04 ⋮ 07	Reserved							
08	Write Retry Count							
09 ⋮ 11	Reserved							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 01h, identifying the current page as the Read-Write Error Recovery page.

Byte 01 – Page Length

This field indicates the number of bytes in the Read-Write Error Recovery page that follow this byte. The valid value for this field is 0Ah (10 bytes).

Byte 02, Bit 5 – TB (Transfer Block)

The TB bit is not supported by the tape drive. The valid value for this bit is 0.

Byte 02, Bit 3 – EER (Enable Early Recovery)

The valid value for this bit is 1.

Byte 02, Bit 2 – PER (Post Error)

The PER bit is not supported by the tape drive. The valid value for this bit is 0.

Byte 02, Bit 1 – DTE (Disable Transfer on Error)

The DTE bit is not supported by the tape drive. The valid value for this bit is 0.

Byte 02, Bit 0 – DCR (Disable Correction)

The DCR bit is not supported by the tape drive. The valid value for this bit is 0.

Byte 03 – Read Retry Count

This field specifies how many times the tape drive attempts its read recovery algorithms. If the tape drive fails to reread the block after this number of attempts, it reports an unrecoverable error. You can set the Read Retry Count to any value between 00h and FFh. The default is FFh.

The value you specify for the Read Retry Count determines what operation the tape drive performs when it encounters an unreadable data block, as follows:

- If you specify 00h for this byte, the tape drive does not attempt any rereads before reporting an unrecoverable read error and continuing with the read operation.
- If you specify 01h to FFh for this byte, the tape drive attempts its read recovery algorithm for either the default number of times or the number specified by this byte, whichever is smaller, before reporting an unrecoverable read error and continuing with the read operation.

Byte 08 – Write Retry Count

This field specifies how many times the tape drive should rewrite a physical block before a recovery is attempted. You can set the Write Retry Count to any value between 00h and FFh. The default value is FFh.

To prevent the tape drive from rewriting any physical blocks, set the Write Retry Count to 0 (00h). When the Write Retry Count is set to 0, the tape drive will abort the write operation the first time it encounters a write error. The tape drive returns Check Condition status with a sense key of Medium Error (3h), with an ASC of 0Ch and ASCQ of 00h (Write Error).

Disconnect-Reconnect Page (Page Code 02h)

The Disconnect-Reconnect page specifies parameters that control how the tape drive disconnects and reconnects during data transfers.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	Buffer Full Ratio							
03	Buffer Empty Ratio							
04	(MSB)		Bus Inactivity Limit					(LSB)
05								
06	(MSB)		Disconnect Time Limit					(LSB)
07								
08	(MSB)		Connect Time Limit					(LSB)
09								
10	(MSB)		Maximum Burst Size					(LSB)
11								
12	Reserved						DTDC	
13	Reserved							
14								
15								

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 02h, identifying the current page as the Disconnect-Reconnect page.

Byte 01 – Page Length

This field indicates the number of bytes in the Disconnect-Reconnect page that follow this byte. The valid value for this field is 0Eh (14 bytes).

Byte 02 – Buffer Full Ratio

The tape drive does not support this field. The valid value for this field is 0. The tape drive manages the data buffer by adjusting the tape speed and by pausing and resuming tape motion as necessary to match the initiator's data transfer rate.

Byte 03 – Buffer Empty Ratio

The tape drive does not support this field. The valid value for this field is 0. The tape drive manages the data buffer by adjusting the tape speed and by pausing and resuming tape motion as necessary to match the initiator's data transfer rate.

Bytes 04 and 05 – Bus Inactivity Limit

The tape drive does not support this field. The valid value for this field is 0.

Bytes 06 and 07 – Disconnect Time Limit

The tape drive does not support this field. The valid value for this field is 0.

Bytes 08 and 09 – Connect Time Limit

The tape drive does not support this field. The valid value for this field is 0.

Bytes 10 and 11 – Maximum Burst Size

This field specifies the amount of data, in 512-byte increments, that can be transferred between the initiator and the tape drive before a disconnect is required. The tape drive supports all values for this field. The default is 0, which means that there is no limit to the amount of data that can be transferred before a disconnect is required.

Byte 12, Bits 1 and 0 – DTDC (Data Transfer Disconnect Control)

This field specifies how the tape drive should perform a disconnect. Table 5-18 lists the valid values for this field.

Table 5-18 *Valid values for the MODE SELECT DTDC field*

DTDC Value	Description
00b	Disconnects are not controlled by the DTDC field. Disconnects are controlled by the other fields on this page. (Power-on default)
01b	Once the data transfer of a command has started, the tape drive should not disconnect until all of the data has been transferred. The Maximum Burst Size (bytes 10 and 11) must be set to 0.
10b	Not valid.
11b	Once the data transfer of a command has started, the tape drive should not disconnect until the command is complete. The Maximum Burst Size (bytes 10 and 11) must be set to 0.

Data Compression Page (Page Code 0Fh)

The Data Compression page enables you to turn data compression on or off at any position on the tape. To turn compression off, send this page with the DCE bit set to 0. To turn compression back on, send this page with the DCE bit set to 1

.

Byte \ Bit	7	6	5	4	3	2	1	0
00	RSVD		Page Code					
01	Page Length							
02	DCE	DCC	Reserved					
03	DDE	RED		Reserved				
04 ⋮ **07**	(MSB)	Compression Algorithm						(LSB)
08 ⋮ **11**	(MSB)	Decompression Algorithm						(LSB)
12 ⋮ **15**	Reserved							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 0Fh, identifying the current page as the Data Compression page.

Byte 01 – Page Length

This field indicates the number of bytes in the Data Compression page that follow this byte. The valid value for this field is 0Eh (14 bytes).

Byte 02, Bit 7 – DCE (Data Compression Enable)

This field enables or disables data compression, as follows:

0	Data compression is disabled.
1	Data compression is enabled (default setting).

The setting of the DCE bit remains in effect across all operations (rewinds, loads, and so forth) until you change it. You can change the default setting using the DfNoCmp (Default No Compression) bit on the Vendor Unique Parameters Page 1 mode page (see page 199).

Byte 02, Bit 6 – DCC (Data Compression Capable)

The tape drive ignores this bit in the MODE SELECT command.

Byte 03, Bit 7 – DDE (Data Decompression Enable)

This field indicates whether data decompression is enabled. The tape drive automatically decompresses compressed data before sending it to the initiator. The tape drive ignores this bit.

Byte 03, Bits 6 and 5 – RED (Report Exception on Decompression)

The tape drive does not report exceptions on decompression (boundaries between compressed and uncompressed data). The valid value for this field is 0.

Bytes 04 through 07 – Compression Algorithm

The tape drive ignores this field in the MODE SELECT command.

Bytes 08 through 11 – Decompression Algorithm

The tape drive ignores this field in the MODE SELECT command.

Device Configuration Page (Page Code 10h)

Byte \ Bit	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	RSVD	CAP	CAF	Active Format				
03	Active Partition							
04	Write Buffer Full Ratio							
05	Read Buffer Empty Ratio							
06	(MSB) Write Delay Time (LSB)							
07								
08	DBR	BIS	RSmk	AVC	SOCF		RBO	REW
09	Gap Size							
10	EOD Defined			EEG	SEW	Cln	RSVD	Reserved
11	(MSB) Buffer Size at Early Warning (LSB)							
12								
13								
14	Select Data Compression Algorithm							
15	Reserved							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 10h, identifying the current page as the Device Configuration page.

Byte 01 – Page Length

This field indicates the number of bytes in the Device Configuration page that follow this byte. The valid value for this field is 0Eh.

Byte 02, Bit 6 – CAP (Change Active Partition)

If the loaded tape is partitioned, this bit indicates that you want to move the tape from the current partition to a new partition specified by the Active Partition byte (byte 03), as follows:

0	Do not change the active partition.
1	Change the active partition to the partition specified by the Active Partition byte. Changing partitions may cause tape motion.

If this bit is set to 1, the tape drive positions the tape to the logical beginning of the new partition (LBOP) after receiving a tape motion command. If the partition specified by the Active Partition field is the same as the currently active partition, the tape drive rewinds to the beginning of the current partition.

Note: If the currently loaded tape does not contain partitions, the value for this bit must be 0.

Byte 02, Bit 5 – CAF (Change Active Format)

The tape drive ignores this field.

Byte 02, Bits 4 through 0 – Active Format

The Active Format function is not implemented. The tape drive ignores this field.

Byte 03 – Active Partition

This field indicates the number of the new partition to which the tape is to be moved (if you set the CAP bit to 1 to change the active partition). The tape positioned to the logical beginning of partition (LBOP) for the specified partition. The valid values for this field are 0 and 1.

Notes:

- If the tape is not partitioned, the value in the Active Partition field must be 0.
- If the CAP bit is 0, the tape drive ignores the Active Partition byte.
- If you specify a partition that does not exist, the tape drive returns Check Condition status with the sense key set to Illegal Request.

Byte 04 – Write Buffer Full Ratio

The tape drive does not support this field. The valid value for this field is 0. The tape drive manages the data buffer by adjusting the tape speed and by pausing and resuming tape motion as necessary to match the initiator's data transfer rate.

Byte 05 – Read Buffer Empty Ratio

The tape drive does not support this field. The valid value for this field is 0. The tape drive manages the data buffer by adjusting the tape speed and by pausing and resuming tape motion as necessary to match the initiator's data transfer rate.

Bytes 06 and 07 – Write Delay Time

The value specified by this field determines the maximum amount of time, in units of 100 msec, that the data will remain in the buffer in the absence of an event that would normally empty the buffer. When the time specified by Write Delay Time elapses, the data in the buffer is written to tape.

Valid values for this field are 0000h to FFFFh. The default value for this field is 0000h. Any value greater than 1999h (approximately 11 minutes) is automatically set to 1999h. At the end of the time specified by this field, the data in the buffer is written to tape, followed by an EOD mark; drum rotation is stopped.

Note: The longest time that data remains in the buffer before being written to tape is 10 minutes.

Byte 08, Bit 7 – DBR (Data Buffer Recovery)

The tape drive does not support data buffer recovery. The valid value for this bit is 0.

Byte 08, Bit 6 – BIS (Block Identifier Supported)

The tape drive ignores this field in the MODE SELECT command.

Byte 08, Bit 5 – RSmk (Report Setmarks)

This field specifies whether the tape drive returns Check Condition status when it encounters a setmark on the tape during read, verify, space block, or space filemark operations, as follows:

0	Do not report setmarks (setmarks are ignored).
1	Report setmarks (default setting).

If the RSmk bit is 1 and the tape drive encounters a setmark, it returns Check Condition status with the sense key set to No Sense (0h). The ASC and ASQ fields are set to 00h and 03h, respectively.

Byte 08, Bit 4 – AVC (Automatic Velocity Control)

The tape drive always uses automatic velocity control and ignores this bit.

Byte 08, Bits 3 and 2 – SOCF (Stop on Consecutive Filemarks)

The tape drive does not support the SOCF field. The valid value for this bit is 0.

Byte 08, Bit 1 – RBO (Recover Buffer Order)

The tape drive does not support the RBO bit. The valid value for this bit is 0.

Byte 08, Bit 0 – REW (Report Early Warning)

This field indicates whether reporting of the early-warning condition (approaching LEOP) during a read operation is enabled or disabled, as follows:

0	Do not report early-warning condition for read operations; only report early warning condition for write operations (default setting).
1	Report early-warning condition after completing the current READ or WRITE command.

The tape drive reports an early-warning condition as a Check Condition status with the sense key set to No Sense. The EOM bit is set to 1 and the LBOT bit is set to 0 in the extended sense data.

Byte 09 – Gap Size

The tape drive does not support the Gap Size field. The valid value for this field is 0.

Byte 10, Bits 7 through 5 – EOD Defined

The tape drive does not support the EOD field. The valid value for this field is 0.

Byte 10, Bit 4 – EEG (Enable EOD Generation)

The tape drive ignores this bit in the MODE SELECT command.

Byte 10, Bit 3 – SEW (Synchronize at Early Warning)

The tape drive ignores this bit in the MODE SELECT command.

Byte 10, Bit 2 – Cln (Check Condition on Clean)

This bit determines whether the tape drive returns Check Condition status when cleaning is required, as follows:

0	Do not return Check Condition status when cleaning is required (default).
1	Return Check Condition status when cleaning is required.

TapeAlert Page (Page Code 1Ch)

The TapeAlert page allows you to configure how the tape drive uses the TapeAlert function.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	Perf	Reserved			DExcpt	Test	RSVD	LogErr
03	Reserved				MRIE			
04 ⋮ 07	Interval Timer							
08 ⋮ 11	Test Flag Number							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 1Ch, which identifies the current page as the TapeAlert page.

Byte 01 – Page Length

This field indicates the number of bytes in the TapeAlert page that follow this byte. The valid value for this field is 0Ah.

Byte 02, Bit 7 – Perf (Performance)

This field specifies whether logging of informational exception operations that can cause delays are acceptable, as follows:

0	Delays due to logging are not allowed (default setting).
1	Delays due to logging are allowed.

Byte 02, Bit 3 – DExcpt (Disable Exception Reporting)

This field determines how the tape drive handles the reporting of informational exception operations, as follows:

0	The tape drive reports informational exceptions using the method specified by the MRIE field.
1	The tape drive disables all informational exception operations. The MRIE field is ignored (default setting).

Byte 02, Bit 2 – Test

This field determines whether the tape drive performs the TapeAlert test specified in the Test Flag Number field, as follows:

0	The tape drive does not generate any false informational exception conditions.
1	The tape drive generates a false informational exception condition based on the Test Flag Number field (default setting). The next SCSI command after the MODE SELECT command returns Check Condition status with sense key set to Unit Attention (6h). The ASC and ASCQ fields are set to 5Dh and 00h, respectively. If the Test Flag Number is set to 0 and both the Test and DExcpt bits are set to 1, then the MODE SELECT command will be rejected as an Illegal Request.

Byte 02, Bit 0 – LogErr

This field indicates whether the tape drive logs informational exception conditions. The tape drive ignores the LogErr bit.

Byte 03, Bits 3 through 0 – MRIE (Method of Reporting Exception Information)

This field indicates the method used by the tape drive to report informational exception conditions. Table 5-19 lists the valid values for MRIE.

Table 5-19 *Valid values for MRIE in the MODE SELECT command*

MRIE	Description
0h	Do not report informational exceptions.
2h	Generate a Check Condition status with the sense key set to Unit Attention (6h).
3h	Generate a Check Condition status with the sense key set to Recovered Error (01h), if the reporting of recovered errors is allowed. Since the tape drive does not support the PER bit (see page 203), this setting has the same effect as setting MRIE to 0h.
4h	Generate a Check Condition status with the sense key set to Recovered Error (01h), regardless of the PER bit.
5h	Generate a Check Condition status with the sense key set to No Sense (00h).
6h	Report informational exceptions only in response to an unsolicited REQUEST SENSE command.

Bytes 04 through 07 – Interval Timer

The tape drive does not support this field. The valid value for this field is 0.

Bytes 08 through 11 – Test Flag Number

The value in this field indicates what action the tape drive should take if the Test bit is set to 1, as follows:

Table 5-20 *Test Flag Number settings for MODE SELECT*

Test Flag Number	Description
0	Generate a false information exception condition.
1 through 64	Set the TapeAlert Flag indicated by the number and process.
–1 through –64	Clear the TapeAlert Flag indicated by the number.
32767	Set all supported TapeAlert Flags. See Table 5-13 on page 196 for a list of the supported TapeAlert Flags.

Exceptions and Error Conditions

Table 5-21 lists the exceptions and error conditions that cause the tape drive to return Check Condition status for the MODE SELECT command.

Note: If the Medium Partition page is sent, causing the current tape to be formatted, motion and write errors may occur. See the WRITE command (WRITE (0Ah) on page 265) for error conditions that may arise in this situations.

Table 5-21 *REQUEST SENSE data for MODE SELECT command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
5h	1Ah	00h	**Illegal Request.** Parameter List Length Error. The Parameter List Length was too small and caused the Parameter List Header, the Block Descriptor, or a parameter page to be truncated.
5h	24h	00h	**Illegal Request.** Invalid field in the CDB.The SP bit in the CDB is set to 1.
5h	25h	00h	**Illegal Request.** Logical unit not supported.
5h	26h	00h	**Illegal Request.** Parameter List Length Error. The Page Length does not match the actual length of the specified page.

Table 5-21 *REQUEST SENSE data for MODE SELECT command errors and exceptions (continued)*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
5h	26h	02h	**Illegal Request.** Invalid value in parameter list. This error is a result of any of the following: ▸ The Buffered Mode field in the Parameter List Header is not set to either 000b (unbuffered) or 001b (buffered). ▸ The Block Descriptor Length field in the Parameter List Header is not set to either 00h (no descriptor) or 08h (the size of the Block Descriptor). ▸ The Block Length field in the Block Descriptor is set to a value greater than 3C00h (240 bytes). ▸ The Block Length field in the Block Descriptor is set to a non-zero value (fixed-length blocks) and the specified value is not evenly divisible by 4. ▸ The Page Length field for the specified page does not match the actual length of the field. ▸ The TB, EER, PER, DTE, or DCR bit in the Read-Write Recovery page are set to 1. ▸ The Buffer Full Ratio, Buffer Empty Ratio, Bus Inactivity Limit, Disconnect Time Limit, or Connect Time Limit field in the Disconnect-Reconnect page is not set to 0. ▸ The QErr, EECA, RAENP, UAAENP, or EAENP bit in the Control Mode page is set to 1. ▸ The DQue field in the Control Mode page is set to 0. ▸ The Queue Algorithm Modifier or Ready AEN Holdoff Period field in the Control Mode page is not set to 0. ▸ The RED field in the Data Compression page is set to 1. ▸ The Compression Algorithm or Decompression Algorithm field in the Data Compression page is not set to 0. ▸ The CAF, DBR, RBO field in the Device Configuration page is set to 1. ▸ The Active Format, Write Buffer Full Ratio, Read Buffer Full, SOCF, Gap Size, EOD, Buffer Size at Early Warning, or Select Data Compression Algorithm field in the Device Configuration page is not set to 0.
6h	2Ah	01h	**Unit Attention.** MODE SELECT parameters have been changed.The tape drive sends status to all other initiators on the SCSI bus.
Bh	47h	00h	**Aborted Command.** SCSI parity error. The command was aborted because of a SCSI bus parity error.

MODE SENSE (1Ah)

The MODE SENSE command allows the tape drive to report medium and device parameters to the initiator. These parameters apply to all initiators in a multi-initiator environment. The parameters are transferred to the initiator as a parameter list comprised of the following:

- Parameter List Header
- Block Descriptor (optional)
- One or more pages of related mode parameters

The values returned in response to this command reflect values set by previous MODE SELECT commands or the default values (if the tape drive has been power-cycled or reset by either a SCSI bus reset or a Bus Device Reset).

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	1	1	0	1	0
01	Reserved				DBD	Reserved		
02	PC		Page Code					
03	Reserved							
04	Allocation Length							
05	Control							

CDB Field Definitions

Byte 01, Bit 3 – DBD (Disable Block Descriptor)

This field indicates whether the tape drive returns the Block Descriptor as part of the MODE SENSE parameter data, as follows:

0	Send the Block Descriptor
1	Do not send the Block Descriptor

Byte 02, Bits 7 and 6 – PC (Page Control)

This field specifies the type of mode parameter values to be returned in the MODE SENSE data. Table 5-22 lists the valid values for this field.

Table 5-22 *Valid values for the PC field in the MODE SENSE command*

PC Setting	Description
00b	Return the values set by the last successful MODE SELECT command or if a MODE SELECT command has not been executed since the last tape drive reset, return the power-on default values.
01b	Return all values that are changeable. The changeable values are indicated by a 1 in each bit of each changeable field.
10b	Return the default values. (Values set in the EEPROM.)
11b	Return saved parameters. Not supported.

Byte 02, Bits 5 through 0 – Page Code

This field specifies which MODE SENSE parameter page or pages the initiator is requesting. Table 5-23 lists the valid values for this field.

Table 5-23 *Valid values for the Page Code field in the MODE SENSE command*

Specify this Page Code...	To return this Mode page...	With this Page Length
01h	Read-Write Error Recovery Page	18h (24 bytes)
02h	Disconnect/Reconnect Page	1Ch (28 bytes)
0Fh	Data Compression Page	1Ch (28 bytes)
10h	Device Configuration Page	1Ch (28 bytes)
1Ch	Information Exceptions Page	18h (24 bytes)
3Fh	All available pages (in ascending page code order)	80h (128 bytes)[a]

[a] This is the sum of all of the individual pages.

Byte 04 – Allocation Length

The Allocation Length indicates the amount of memory in bytes that the initiator has allocated for the return of MODE SENSE parameters. To determine the Allocation Length, total the number of bytes in the Parameter List Header (4 bytes), Block Descriptor (8 bytes, if you are requesting it), and all parameter pages you are requesting. Or, to receive all available data, specify 80h (128 bytes). Table 5-23 lists the page lengths of all the supported mode pages.

If the Allocation Length is smaller than the amount of data available from the tape drive, the returned data is truncated. If the Allocation Length is greater than the amount of data to be returned, only the number of bytes available are transferred; no additional data is transferred.

What the Tape Drive Returns

This section describes the mode sense page format and the mode sense pages that the tape drive supports. The MODE SENSE command returns the single mode sense page specified in the Page Code field of the CDB.

Each mode sense page begins with a four-byte Parameter List Header (bytes 00 through 03), followed by zero or more variable-length mode parameters defined for that page. The Parameter List Header specifies the page code for the mode sense parameter data being returned and indicates the total length of the data to follow.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Mode Data Length							
01	Medium Type							
02	WP	Buffered Mode			Speed			
03	Block Descriptor Length							

Byte 00 – Mode Data Length

This field indicates the number of bytes of MODE SENSE data that are available for transfer, excluding this field. The value returned for this field is the remaining number of bytes in the Parameter List Header plus the number of bytes of data to be returned based on the field settings in the CDB.

Note: The value returned for the Mode Data Length does not reflect the value you specified for the Allocation Length in the CDB.

Byte 01 – Medium Type

This field indicates the type of media in the data cartridge currently loaded in the tape drive. The value of this field is 44h, Ultrium-3.

Byte 02, Bit 7 – WP (Write Protect)

This field indicates whether the data cartridge loaded in the tape drive is write protected, as follows:

0	The data cartridge is not write protected.
1	The data cartridge is write protected.

Byte 02, Bits 6 through 4 – Buffered Mode

This field indicates the data transfer mode to be used by the tape drive during a write operation, as follows:

000b	Unbuffered mode
001b	Buffered mode (Power-on default)

In buffered mode, status is returned when the last block of data has been transferred to the tape drive's buffer. See Data Buffering on page 266 for a detailed description of how data is buffered.

In unbuffered mode, status is returned only after the data has actually been written to the tape.

Byte 02, Bits 3 through 0 – Speed

The value returned for this field is 0, indicating that the tape drive operates as a variable-speed device and automatically determines the optimum speed required.

Byte 03 – Block Descriptor Length

This byte indicates the length of the Block Descriptor in bytes, as follows:

00h	No Block Descriptor is included.
08h	An 8-byte Block Descriptor is included.

Note: The tape drive does not support multiple block descriptors.

Block Descriptor

Byte \ Bit	7	6	5	4	3	2	1	0
00	Density Code							
01	(MSB)			Number of Blocks				(LSB)
02								
03								
04	Reserved							
05	(MSB)			Block Length				(LSB)
06								
07								

Byte 00 – Density Code

This field indicates the format of the data cartridge currently in the tape drive. If a data cartridge is not loaded or the tape is not formatted, this field indicates the preferred format for the tape. The value of this field is 44h, Ultrium-3.

Bytes 01 through 03 – Number of Blocks

This field indicates the total capacity of the tape, between LBOT and LEOT, in approximately 16-KB physical units (the default block size).

Bytes 05 through 07 – Block Length

This field indicates the length of each logical block, in bytes, when the Fixed bit is set for the READ, VERIFY, and WRITE commands. Valid values for this field are 0h to 3C000h (240 KB).

- When the Block Length is non-zero, fixed-length block operations are allowed. For fixed-length blocks, only block sizes that are evenly divisible by four (that is, they end on a 4-byte boundary) are valid. A block length of 0 is invalid for fixed-length blocks.
- When the Block Length is 0, only variable-length block operations are allowed.

Note: If the Block Length is 0, the SILI bit in the READ command suppresses illegal length indications for both underlength and overlength reads. If the Block Length is non-zero, the SILI bit of the READ command suppresses illegal length indications only for blocks shorter than requested. See page 234 for more information.

Read-Write Error Recovery Page (Page Code 01h)

The Read-Write Error Recovery page returns the error recovery parameters used by the tape drive during read-write operations.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	Reserved		TB	RSVD	EER	PER	DTE	DCR
03	Read Retry Count							
04 ⋮ 07	Reserved							
08	Write Retry Count							
09 ⋮ 11	Reserved							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 01h, identifying the current page as the Read-Write Error Recovery page.

Byte 01 – Page Length

This field indicates the number of bytes in the Read-Write Error Recovery page that follow this byte. The valid value for this field is 0Ah.

Byte 02, Bit 5 – TB (Transfer Block)

The TB bit is not supported by the tape drive. The valid value for this bit is 0.

Byte 02, Bit 3 – EER (Enable Early Recovery)

The valid value for this bit is 1.

Byte 02, Bit 2 – PER (Post Error)

The PER bit is not supported by the tape drive. The valid value for this bit is 0.

Byte 02, Bit 1 – DTE (Disable Transfer on Error)

The DTE bit is not supported by the tape drive. The valid value for this bit is 0.

Byte 02, Bit 0 – DCR (Disable Correction)

The DCR bit is not supported by the tape drive. The valid value for this bit is 0.

Byte 03 – Read Retry Count

This field indicates how many times the tape drive attempts its read recovery algorithms. If the tape drive fails to reread the block after this number of attempts, it reports an unrecoverable error. The default value is 05h.

Byte 08 – Write Retry Count

This field indicates how many times the tape drive rewrite a physical block before reporting an unrecoverable read error. The default value is 05h.

Disconnect-Reconnect Page (Page Code 02h)

The Disconnect-Reconnect page returns the parameters that control how the tape drive disconnects and reconnects during data transfers.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	Buffer Full Ratio							
03	Buffer Empty Ratio							
04	(MSB)	Bus Inactivity Limit						(LSB)
05								
06	(MSB)	Disconnect Time Limit						(LSB)
07								
08	(MSB)	Connect Time Limit						(LSB)
09								
10	(MSB)	Maximum Burst Size						(LSB)
11								
12	Reserved						DTDC	
13	Reserved							
14								
15								

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 02h, identifying the current page as the Disconnect-Reconnect page.

Byte 01 – Page Length

The value returned for this field is 0Eh, indicating that 14 bytes of data for the Disconnect-Reconnect page follow this byte.

Byte 02 – Buffer Full Ratio

The tape drive does not support this field. The value returned for this field is 0. The tape drive manages the data buffer by adjusting the tape speed and by pausing and resuming tape motion as necessary to match the initiator's data transfer rate.

Byte 03 – Buffer Empty Ratio

The tape drive does not support this field. The value returned for this field is 0. The tape drive manages the data buffer by adjusting the tape speed and by pausing and resuming tape motion as necessary to match the initiator's data transfer rate.

Bytes 04 and 05 – Bus Inactivity Limit

The tape drive does not support this field. The value returned for this field is 0, indicating that the tape drive may assert the Bsy (Busy) signal for an indefinite period of time.

Bytes 06 and 07 – Disconnect Time Limit

The tape drive does not support this field. The value returned for this field is 0.

Bytes 08 and 09 – Connect Time Limit

The tape drive does not support this field. The value returned for this field is 0.

Bytes 10 and 11 – Maximum Burst Size

This field indicates the amount of data, in 512-byte increments, that can be transferred between the initiator and the tape drive before a disconnect is required. The tape drive supports all values for this field. The default is 0, which means that there is no limit to the amount of data that can be transferred before a disconnect is required.

Byte 12, Bits 1 and 0 – DTDC (Data Transfer Disconnect Control)

This field indicates how the tape drive performs a disconnect. Table 5-24 lists the valid values for this field.

Table 5-24 *Values returned in the MODE SENSE DTDC field*

DTDC Value	Description
00b	Disconnects are not controlled by the DTDC field. Disconnects are controlled by the other fields on this page. (Power-on default)
01b	Once the data transfer of a command has started, the tape drive should not disconnect until all of the data has been transferred. The Maximum Burst Size (bytes 10 and 11) must be set to 0.
10b	Not valid.
11b	Once the data transfer of a command has started, the tape drive should not disconnect until the command is complete. The Maximum Burst Size (bytes 10 and 11) must be set to 0.

Data Compression Page (Page Code 0Fh)

The Data Compression page indicates the parameters used by the tape drive to control data compression.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	DCE	DCC	Reserved					
03	DDE	RED		Reserved				
04 ⋮ 07	(MSB)	Compression Algorithm						(LSB)
08 ⋮ 11	(MSB)	Decompression Algorithm						(LSB)
12 ⋮ 15	Reserved							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 0Fh, identifying the current page as the Data Compression page.

Byte 01 – Page Length

The value returned for this field is 0Eh, indicating that 14 bytes of data for the Data Compression page follow this byte.

Byte 02, Bit 7 – DCE (Data Compression Enable)

This field indicates the current state of data compression, as follows:

0	Data compression is disabled.
1	Data compression is enabled.

Byte 02, Bit 6 – DCC (Data Compression Capable)

The value for this field is 01h, indicating that the tape drive is capable of compressing data.

Byte 03, Bit 7 – DDE (Data Decompression Enable)

The value returned for this field is 01h, indicating that data decompression is enabled. The tape drive automatically decompresses compressed data before sending it to the initiator.

Byte 03, Bits 6 and 5 – RED (Report Exception on Decompression)

The tape drive does not report exceptions on decompression (boundaries between compressed and uncompressed data). The value returned for this field is 0.

Bytes 04 through 07 – Compression Algorithm

The value returned for this field is 10h, indicating that the tape drive uses the ALDC data compression algorithm with a 512-byte buffer to compress data from the initiator.

Bytes 08 through 11 – Decompression Algorithm

The value returned for this field is 10h, indicating that the tape drive uses the ALDC data decompression algorithm with a 512-byte buffer to decompress data from tape.

Device Configuration Page (Page Code 10h)

Byte \ Bit	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	RSVD	CAP	CAF	Active Format				
03	Active Partition							
04	Write Buffer Full Ratio							
05	Read Buffer Empty Ratio							
06	(MSB) Write Delay Time							(LSB)
07								
08	DBR	BIS	RSmk	AVC	SOCF		RBO	REW
09	Gap Size							
10	EOD Defined			EEG	SEW	Cln	RSVD	Reserved
11	(MSB) Buffer Size at Early Warning							(LSB)
12								
13								
14	Select Data Compression Algorithm							
15	Reserved							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 10h, identifying the current page as the Device Configuration page.

Byte 01 – Page Length

The value returned for this field is 0Eh, indicating that 14 bytes of additional data for the Device Configuration page follow this byte.

Byte 02, Bit 6 – CAP (Change Active Partition)

The value returned for this bit is always 0.

Byte 02, Bit 5 – CAF (Change Active Format)

The value returned for this bit is always 0.

Byte 02, Bits 4 through 0 – Active Format

The tape drive does not support this field. The value returned for this field is 0.

Byte 03 – Active Partition

This field indicates the number of the partition in which the tape is currently positioned, as follows:

n – The tape is positioned at partition *n*, where *n* is either 0 or 1. Note that partitions are numbered consecutively from the *end* of the tape. Partition 0 is always the last partition on the tape.

Notes:

- If the tape is not partitioned, the value in the Active Partition field must be 0.
- If the CAP bit is 0, the tape drive ignores the Active Partition byte.
- If you specify a partition that does not exist, the tape drive returns Check Condition status with the sense key set to Illegal Request.

Byte 04 – Write Buffer Full Ratio

The tape drive does not support this field. The valid value for this field is 0. The tape drive manages the data buffer by adjusting the tape speed and by pausing and resuming tape motion as necessary to match the initiator's data transfer rate.

Byte 05 – Read Buffer Empty Ratio

The tape drive does not support this field. The valid value for this field is 0. The tape drive manages the data buffer by adjusting the tape speed and by pausing and resuming tape motion as necessary to match the initiator's data transfer rate.

Bytes 06 and 07 – Write Delay Time

If a WRITE command completes without transferring enough data to exceed the value specified for the Write Buffer Full Ratio, the value returned in this field indicates the maximum amount of time, in units of 100 msec, that the data will remain in the buffer. When the time specified by Write Delay Time elapses, the data in the buffer is written to tape.

Valid values for this field are 0000h to FFFFh. The default value for this field is 0000h. Any value greater than 1999h (approximately 11 minutes) is automatically set to 1999h.

Byte 08, Bit 7 – DBR (Data Buffer Recovery)

The tape drive does not support the DBR bit. The value returned for this bit is 0.

Byte 08, Bit 6 – BIS (Block Identifier Supported)

The value returned for this bit is 1, indicating that block IDs are written on the tape relative to each partition.

Byte 08, Bit 5 – RSmk (Report Setmarks)

This field indicates whether the tape drive returns Check Condition status when it encounters a setmark on the tape during read, verify, space block, or space filemark operations, as follows:

0	Do not report setmarks (setmarks are ignored).
1	Report setmarks (default setting).

Byte 08, Bit 4 – AVC (Automatic Velocity Control)

The value returned for this bit is always 1, indicating that the tape drive's intelligent velocity control is always enabled.

Byte 08, Bits 3 and 2 – SOCF (Stop on Consecutive Filemarks)

The tape drive does not support the SOCF field. The valid value for this field is 0.

Byte 08, Bit 1 – RBO (Recover Buffer Order)

The tape drive does not support the RBO bit. The valid value for this bit is 0.

Byte 08, Bit 0 – REW (Report Early Warning)

This field indicates whether reporting of the early-warning condition (approaching LEOP) during a read operation is enabled or disabled, as follows:

0	Early-warning condition is not reported for read operations; early-warning condition is reported for write operations (default setting).
1	Early-warning condition is reported after completing the current READ or WRITE command.

The tape drive reports an early-warning condition as a Check Condition status with the sense key set to No Sense. The EOM bit is set to 1 and the LBOT bit is set to 0 in the extended sense data.

Byte 09 – Gap Size

The tape drive does not support the Gap Size field. The valid value for this field is 0.

Byte 10, Bits 7 through 5 – EOD Defined

The tape drive does not support the EOD field. The valid value for this field is 0.

Byte 10, Bit 4 – EEG (Enable EOD Generation)

The tape drive ignores this bit in the MODE SELECT command.

Byte 10, Bit 3 – SEW (Synchronize at Early Warning)

The tape drive ignores this bit in the MODE SELECT command.

Byte 10, Bit 2 – Cln (Check Condition on Clean)

This bit determines whether the tape drive returns Check Condition status when cleaning is required, as follows:

0	Check Condition status is not returned when cleaning is required (default).
1	Check Condition status is returned when cleaning is required.

Bytes 11 through 13 – Buffer Size at Early Warning

The tape drive does not support the Buffer Size at Early Warning field. The valid value for this field is 0.

Byte 14 – Select Data Compression Algorithm

The tape drive does not support the Select Data Compression Algorithm field. The valid value for this field is 0.

TapeAlert Page (Page Code 1Ch)

The TapeAlert page indicates how the TapeAlert function is configured.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	Perf	Reserved			DExcpt	Test	RSVD	LogErr
03	Reserved				MRIE			
04 ⋮ 07	Interval Timer							
08 ⋮ 11	Test Flag Number							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 1Ch, which identifies the current page as the TapeAlert page.

Byte 01 – Page Length

The value returned for this field is 0Ah, indicating that 14 bytes of additional data for the TapeAlert page follow this byte.

Byte 02, Bit 7 – Perf (Performance)

This field indicates whether logging of informational exception operations that can cause delays are acceptable, as follows:

0	Delays due to logging are not allowed (default setting).
1	Delays due to logging are allowed.

Byte 02, Bit 3 – DExcpt (Disable Exception Reporting)

This field indicates how the tape drive handles the reporting of informational exception operations, as follows:

0	The tape drive reports informational exceptions using the method specified by the MRIE field.
1	The tape drive disables all informational exception operations. The MRIE field is ignored (default setting).

Byte 02, Bit 2 – Test

This field indicates whether the tape drive performs the TapeAlert test specified in the Test Flag Number field, as follows:

0	The tape drive does not generate any false informational exception conditions.
1	The tape drive generates a false informational exception condition based on the Test Flag Number field (default setting).

Byte 02, Bit 0 – LogErr

The tape drive does not support the LogErr bit. The value returned for this bit is 0.

Byte 03, Bits 3 through 0 – MRIE (Method of Reporting Exception Information)

This field indicates the method used by the tape drive to report informational exception conditions. Table 5-19 lists the valid values for MRIE.

Table 5-25 *Values returned for MRIE in the MODE SENSE command*

MRIE	Description
0h	Do not report informational exceptions.
2h	Generate a Check Condition status with the sense key set to Unit Attention (6h).
3h	Generate a Check Condition status with the sense key set to Recovered Error (01h), if the reporting of recovered errors is allowed. Since the tape drive does not support the PER bit (see page 203), this setting has the same effect as setting MRIE to 0h.
4h	Generate a Check Condition status with the sense key set to Recovered Error (01h), regardless of the PER bit.
5h	Generate a Check Condition status with the sense key set to No Sense (00h).
6h	Report informational exceptions only in response to an unsolicited REQUEST SENSE command.

Bytes 04 through 07 – Interval Timer

The tape drive does not support this field. The value returned for this field is 0.

Bytes 08 through 11 – Test Flag Number

The value in this field indicates what action the tape drive should take if the Test bit is set to 1, as shown in Table 5-26.

Table 5-26 *Test Flag Number settings for MODE SENSE*

Test Flag Number	Description
0	Generate a false information exception condition.
1 through 64	Set the TapeAlert Flag indicated by the number and process.
–1 through –64	Clear the TapeAlert Flag indicated by the number.
32767	Set all supported TapeAlert Flags. See Table 5-13 on page 196 for a list of the supported TapeAlert Flags.

PREVENT/ALLOW MEDIUM REMOVAL (1Eh)

You can use the PREVENT/ALLOW MEDIUM REMOVAL command to allow or prevent the removal of the data cartridge from the tape drive.

The PREVENT/ALLOW MEDIUM REMOVAL command is reservation independent. The tape drive will execute a PREVENT/ALLOW MEDIUM REMOVAL command issued by any initiator even if the tape drive is reserved by another initiator.

If an initiator has issued a PREVENT MEDIUM REMOVAL (1Eh) command to prevent the removal of the data cartridge, the data cartridge will not be ejected until that initiator sends an ALLOW MEDIUM REMOVAL command to allow the data cartridge to be removed.

If more than one initiator has issued PREVENT MEDIUM REMOVAL commands to the tape drive to prevent the removal of the data cartridge, the cartridge will not be ejected until each of those initiators sends an ALLOW MEDIUM REMOVAL command to release the condition.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	1	1	1	1	0
01	Reserved							
02								
03								
04	Reserved							Prevent
05	Control							

Effect on the Unload Button

When removal of the data cartridge is prevented by the PREVENT/ALLOW MEDIUM REMOVAL command, the tape drive's eject button is disabled; pressing this button does not cause the tape to be rewound or ejected.

Effect on the LOAD/UNLOAD (1Bh) Command

When removal of the data cartridge is prevented by the PREVENT/ALLOW MEDIUM REMOVAL command, issuing a LOAD/UNLOAD (1Bh) command causes the tape to be unloaded from the tape path but not ejected from the tape drive. Any data in the buffer is written to tape before the tape is rewound and unloaded from the tape path.

CDB Field Definitions

Byte 04, Bit 0 – Prevent

This field specifies whether the tape drive prevents or allows the removal of a data cartridge from the tape drive, as follows:

0	Allow the data cartridge to be removed
1	Prevent the data cartridge from being removed

The prevent-data-cartridge-removal condition terminates when any of the following conditions occur:

- A PREVENT/ALLOW MEDIUM REMOVAL command with the Prevent bit set to 0 is received from all initiators that set the prevent condition.
- The tape drive is reset by a Bus Device Reset message, SCSI bus reset, or power-on reset.

READ (08h)

The READ command transfers one or more bytes or blocks of data from the tape drive to the initiator, beginning with the next logical block.

Notes:

- The tape drive can read tapes that have a combination of fixed-length and variable-length data blocks.
- The tape drive will report the early-warning condition (LEOP reached) if the REW bit is set with the MODE SELECT command (byte 8, bit 0 in the Device Configuration page).
- Unexpected events, such as encountering filemarks or EOT, cause the data transfer to stop.
- If the disconnects are allowed, the tape drive may disconnect from the initiator.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	0	1	0	0	0
01	Reserved						SILI	Fixed
02	(MSB)							
03	Transfer Length							
04								(LSB)
05	Control							

CDB Field Definitions

Byte 01, Bit 1 – SILI (Suppress Illegal Length Indication)

The SILI bit is used to suppress an illegal length Check Condition status for read operations that read logical blocks that do not contain the defined number of bytes. This bit is valid only when the read operation is for variable-length logical blocks (that is, when the Fixed bit is set to 0).

0	Do not suppress illegal length indication Check Condition status.
1	Suppress illegal length indication Check Condition status.

Notes:

- If the Fixed bit is 1 (fixed-length logical blocks) and the SILI bit is 1, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h). The ASC and ASCQ fields are set to 24h and 00h.
- If the Fixed bit is 0 and the SILI bit is 1, Check Condition status is suppressed for all cases in which the length of the logical block to be read is less than the length specified by the Transfer Length field. If the length of the logical block is greater than the length specified by the Transfer Length field, Check Condition status is suppressed only if the Block Length field of the MODE SELECT Block Descriptor is 0.
- The tape drive never transfers more data than requested, regardless of the setting of the SILI bit.

Byte 01, Bit 0 – Fixed

The Fixed bit defines the type of read operation to be performed, as follows:

0	Read a single logical block The length of this block is specified in the Transfer Length field.
1	Read one or more fixed-length logical blocks The number of blocks is specified in the Transfer Length field.

Note: The tape drive returns Check Condition status with the sense key set to Illegal Request (5h) if the Fixed field in the READ command is 1 (fixed-length logical blocks) and the Block Length field in the current MODE SELECT data is 0 (variable-length logical block). The ASC and ASCQ bits are set to 81h and 00h (fixed/variable mismatch).

Bytes 02 through 04 – Transfer Length

The Transfer Length field specifies the amount of data to be read, as follows:

- When the Fixed bit is set to 0 (read variable-length blocks), this field contains the length of the logical block in bytes. The logical block can be any size from 1 byte to 240 KB (1 KB = 1,024 bytes). The valid value for this field is from 000001h to 03C000h.
- When the Fixed bit is set to 1 (read fixed-length blocks), this field contains the number of logical blocks to be read. The length of each block is either the power-on default block length or the length specified with the currently active MODE SELECT command (see page 202). Only fixed-length blocks with a size that is evenly divisible by 4 (that is, blocks that end on a 4-byte boundary) are allowed.

The data is read from the next logical block on the tape and is transferred to the initiator.

Note: When the value for the Transfer Length field is 0, no data is transferred and the current position of the tape is not changed. A value of 0 for these bytes is not an error.

Exceptions and Error Conditions

The following sections describe exceptions and error conditions that cause the tape drive to return Check Condition status for the READ command.

Transfer Length Incorrect

If the actual transfer length does not match the requested transfer length, the information reported depends on the setting of the Fixed bit. (The Check Condition status may be suppressed if the SILI bit is set to 1.)

The REQUEST SENSE data is set as follows:

Valid	1
ILI	1
Sense Key	No Sense (0h)
Information bytes	▸ If the Fixed bit is 0, indicate the difference between the requested transfer length and the actual number of logical blocks read. The result may be a negative value, which will be expressed in 2's complement format. ▸ If the Fixed bit is 1, indicate the number of blocks requested, but not transferred.
ASC	00h
ASCQ	00h
FSC	49h

When the READ command terminates in variable mode, the tape is positioned after the block with the incorrect length (at the start of the next logical block). When the READ command terminates in fixed mode, the tape is positioned after the block with the incorrect length (at the start of the next logical block).

Filemark Detected

The tape drive detected a filemark before completing the read operation. The REQUEST SENSE data is set as follows:

Valid	1
Filemark	1
Sense Key	No Sense (0h)
Information bytes	Indicate the difference between the number of bytes or blocks requested and the number of bytes or blocks actually transferred.
ASC	00h
ASCQ	01h (Filemark Detected)
FSC	41h

When the READ command terminates, the logical position is at the EOT side of the filemark encountered.

Setmark Detected

The RSmk bit in the MODE SELECT Device Configuration page (Page Code 10h) is set to 1 and the tape drive detected a setmark before completing the read operation. The REQUEST SENSE data is set as follows:

Valid	1
Filemark	1
Sense Key	No Sense (0h)
Information bytes	Indicate the difference between the number of bytes or blocks requested and the number bytes or blocks actually transferred.
ASC	00h
ASCQ	03h (Setmark Detected)
FSC	40h

When the READ command terminates, the logical position is at the EOT side of the setmark encountered.

PEOT or PEOP Encountered

During a read operation, the tape drive encountered the physical end of tape (PEOT) or the physical end of partition (PEOP). The REQUEST SENSE data is set as follows:

Valid	1
EOM	1
Sense Key	Volume Overflow (0Dh)
Information bytes	Indicate the difference between the number of bytes or blocks requested and the actual number of bytes or blocks actually transferred.
ASC	00h
ASCQ	02h (PEOT or PEOP Detected)
FSC	2Ah, 2Dh

When the READ command terminates, the logical position is undefined.

EOD Detected

The tape drive detected the EOD mark during the read operation. The REQUEST SENSE data is set as follows:

Valid	1
Sense Key	Blank Check (8h)
Information bytes	Indicate the difference between the number of bytes or blocks requested and the actual number of bytes or blocks actually transferred.
ASC	00h
ASCQ	05h (EOD Detected)
PEOT	0
FSC	08h

When the READ command terminates, the logical position is after the last recorded data block, filemark, or setmark.

Unrecoverable Read Error

An unrecoverable read error occurred before the operation completes and the tape drive terminated the READ command. The REQUEST SENSE data is set as follows:

Valid	1
Sense Key	Medium Error (3h) or Hardware Error (4h)
Information bytes	Indicate the difference between the number of bytes or blocks requested and the actual number of bytes or blocks actually transferred.
ASC	11h
ASCQ	00h (Unrecovered Read Error)
FSC	30h, 33h

When the READ command is terminated, the tape drive is positioned after the unrecovered block.

Note: In both fixed and variable block modes, the tape drive may have entered the Data Phase before reporting this error.

Additional Errors

Table 5-27 lists additional exceptions and error conditions that cause the tape drive to return Check Condition status for the READ command.

Table 5-27 *REQUEST SENSE data for READ command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
2h	04h	01h	**Not Ready.** In the process of becoming ready. The tape drive is in the process of initializing itself.
02h	04h	02h	**Not Ready.** Tape drive is not ready because it is in the process of ejecting a cartridge.
2h	04h	03h	**Not Ready.** Manual intervention required. The tape drive requires manual intervention.
2h	3Ah	00h	**Not Ready.** Medium not present. The command requires a tape and no tape is present.
3h	30h	02h	**Medium Error.** Incompatible format. The format of the currently loaded tape is not compatible with the tape drive or the tape drive firmware.
0h	31h	00h	**Medium Error.** Medium format corrupted. The format of the currently loaded tape is corrupted.

***Table 5-27** REQUEST SENSE data for READ command errors and exceptions (continued)*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
4h	11h	02h	**Hardware Error.** Error too long to correct. A CRC error was detected by the decompression hardware. Use the following steps to recover from this error: ▸ Reissue the failed command or command sequence. ▸ Power the tape drive off and back on again. or Send a SCSI bus reset (“hard” reset). ▸ If the error persists, the tape may be bad or the tape drive may require service.
4h	15h	01h	**Hardware Error.** Mechanical positioning error. The tape drive cannot properly position the media.
5h	24h	00h	**Illegal Request.** Invalid field in the CDB. ▸ Both the Fixed and SILI bits are set to 1. ▸ Invalid field in the CDB. The Transfer Length exceeds 3C00h (240 KB) for a variable-block read.
6h	30h	00h	**Unit Attention.** Incompatible medium installed. The currently loaded tape is incompatible with the tape drive.

READ BLOCK LIMITS (05h)

The READ BLOCK LIMITS command requests that the tape drive return data identifying the maximum and minimum logical block lengths supported. The data returned by the READ BLOCK LIMITS command applies to both the variable and fixed block lengths for the READ and WRITE commands.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	0	0	1	0	1
01	Reserved							
02								
03								
04								
05	Control							

CDB Field Definitions

Reserved – Bytes 01 through 05

All fields in this CDB are reserved. The value for these fields must be 0.

What the Tape Drive Returns

The tape drive returns Read Block Limits data to the initiator to indicate the maximum and minimum block lengths it supports, formatted as follows:

Byte \ Bit	7	6	5	4	3	2	1	0
00	Reserved							
01	(MSB)			Maximum Block Length				
02								
03								(LSB)
04	(MSB)			Minimum Block Length				
05								(LSB)

Bytes 01 through 03 – Maximum Block Length

This field indicates the largest valid logical block length supported by the tape drive. The value returned is 3C000h (240 KB).

Note: 1 KB = 1,024 bytes.

Bytes 04 and 05 – Minimum Block Length

This field indicates the smallest valid logical block length supported by the tape drive. The value returned is 00001h (1 byte). For fixed-length blocks the block length must be evenly divisible by 4 (that is, blocks must end on a 4-byte boundary).

READ BUFFER (3Ch)

The Read Buffer command is accepted without error but no action is performed in the target.

READ POSITION (34h)

The READ POSITION command reports the tape drive's current logical position, but does not cause tape motion to occur. As described in READ POSITION (34h) on page 241, the READ POSITION command is used with the LOCATE (2Bh) command to position the tape at a specified logical block address.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	1	1	0	1	0	0
01	Reserved							BT
02 ⋮ **08**	Reserved							
09	Control							

CDB Field Definitions

Byte 01, Bit 0 – BT (Block Type)

This bit determines the type of block number the tape drive returns to the initiator. The tape drive ignores this field.

What the Tape Drive Returns

When it completes the READ POSITION command, the tape drive returns 20 bytes of Read Position data to the initiator, formatted as follows:

Byte \ Bit	7	6	5	4	3	2	1	0
00	BOP	EOP	Reserved			BPU	Reserved	
01	Partition Number							
02	Reserved							
03								
04	(MSB)	First Block Location						
⋮								
07								(LSB)
08	(MSB)	Last Block Location						
⋮								
11								(LSB)
12	Reserved							
13	(MSB)	Number of Blocks in Buffer						
⋮								
15								(LSB)
16	(MSB)	Number of Bytes in Buffer						
⋮								
19								(LSB)

Byte 00, Bit 7 – BOP (Beginning of Partition)

This field indicates whether the tape is positioned at the beginning of a partition, as follows:

0	The tape is not positioned at the beginning of a partition.
1	For a partitioned tape, the tape is positioned at the logical beginning of the currently active partition (LBOP). For a non-partitioned tape, the tape is positioned at LBOT.

Byte 00, Bit 6 – EOP (End of Partition)

This field indicates whether the tape is positioned at the end of a partition, as follows:

0	The tape is not positioned at the end of a partition.
1	For a partitioned tape, the tape is positioned between the logical end of partition (LEOP) and the physical end of partition (PEOP) of the currently active partition. For a non-partition tape, the tape is positioned between LEOT and PEOT.

Byte 00, Bit 2 – BPU (Block Position Unknown)

This field indicates whether the block position is known, as follows:

0	The block position is known and the remainder of the READ POSITION data is valid.
1	The block position is not known and cannot be obtained without tape motion. The remainder of the READ POSITION data is not valid.

Byte 01 – Partition Number

This field indicates the number of the partition in which the tape is currently located. The valid value for this field is either 0 or 1. The tape drive supports one partition in addition to partition 0. Partition 0 is always the last partition on the tape.

Note: If the tape is not partitioned, the tape drive returns a value of 0.

Bytes 04 through 07 – First Block Location

This field indicates the block address associated with the current logical block position (that is, the logical block address of the next data block to be transferred between the initiator and the tape drive if a READ or WRITE command is issued). When using a LOCATE command to search for this position, specify the value returned for this field as the Block Address in byte 03 through 06 of the LOCATE CDB.

Note: If a READ POSITION command follows a command that requires immediate action, the block location returned by this command represents the expected tape position after the immediate command is completed.

Bytes 08 through 11 – Last Block Location

The Last Block Location field is not supported by the tape drive. The value returned for this field is 0.

Bytes 13 through 15 – Number of Blocks in Buffer

The Number of Blocks in Buffer field is not supported by the tape drive. The value returned for this field is 0.

Bytes 16 through 19 – Number of Bytes in Buffer

The Number of Bytes in Buffer field is not supported by the tape drive. The value returned for this field is 0.

Exceptions and Error Conditions

Table 5-2 lists exceptions and error conditions that cause the tape drive to return Check Condition status for the READ POSITION command.

Table 5-28 *REQUEST SENSE data for READ POSITION command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Explanation
02h	04h	01h	**Not Ready.** Tape drive is not ready, but is in process of becoming ready (rewinding or loading tape).
02h	04h	03h	**Not Ready.** The tape drive is not ready because it needs manual intervention.
02h	3Ah	00h	**Not Ready.** Tape drive is not ready. Command requires a tape, and no tape is present.
03h	30h	02h	**Medium Error.** The tape format is incompatible with the tape drive hardware or microcode.
05h	24h	00h	**Illegal Request.** Invalid field in the CDB. The BT bit is set to 1.
06h	30h	00h	**Unit Attention.** Incompatible media was rejected after the cartridge was inserted.
08h	00h	00h	**Blank Check.** The media has not been formatted.

RELEASE UNIT (17h)

The RELEASE UNIT command releases a tape drive from an initiator's exclusive use or, if third-party reservations are in effect, from another SCSI device's use. To have effect, the command must be issued by the initiator that reserved the tape drive with a RESERVE UNIT command.

It is not an error to attempt to release a tape drive that is not currently reserved by the current initiator, but if the tape drive is reserved by another initiator, then that reservation remains in effect.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	1	1
01	Reserved			3rdPty	Third Party Device ID			RSVD
02	Reserved							
03								
04								
05	Control							

CDB Field Definitions

Byte 01, Bit 4 – 3rdPty (Third Party)

This field indicates whether the release is direct reservation or a third-party reservation, as follows:

0	Release is for a direct reservation
1	Release is for a third-party reservation

Byte 01, Bits 3 through 1 – Third Party Device ID

This field indicates the SCSI ID of the initiator that reserved the tape drive. The tape drive ignores this field if the initiator is not requesting a third-party reservation release.

REQUEST SENSE (03h)

The REQUEST SENSE command requests that the tape drive transfer sense data to the initiator.

The sense data is valid for the Check Condition status just presented to the initiator. The tape drive preserves the sense data for the initiator receiving the Check Condition status until it is cleared by that initiator. Sense data is cleared when the tape drive receives any subsequent command other than INQUIRY (12h) from the initiator that received the Check Condition status.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	1	1
01	Reserved							
02	Reserved							
03								
04	Allocation Length							
05	Control							

DB Field Definitions

Byte 04 – Allocation Length

This field specifies the number of bytes that the initiator should allocate for the returned sense data. The tape drive provides a total of 20 bytes (14h) of sense data. If you specify an Allocation Length of less than 14h, the returned sense data is truncated. If the Allocation Length is greater than the amount of data to be returned, only the number of bytes available are transferred; no additional data is transferred.

What the Tape Drive Returns

When the tape drive receives a REQUEST SENSE command, it returns 20 (14h) bytes of extended sense data if the Allocation Length is sufficient.

Byte \ Bit	7	6	5	4	3	2	1	0
00	Valid	Error Code						
01	Reserved							
02	FMK	EOM	ILI	RSVD	Sense Key			
03 ⋮ **06**	(MSB)	Information						(LSB)
07	Additional Sense Length							
08 ⋮ **11**	(MSB)	Command Specific Information						(LSB)
12	Additional Sense Code (ASC)							
13	Additional Sense Code Qualifier (ASCQ)							
14	Field Replaceable Unit Code							
15	Sense Key Specific Data							
16								
17								
18	Reserved							
19								

Byte 00, Bit 7 – Valid

This field indicates whether the sense data in the Information field (bytes 03 through 06) is valid (conforms to the SCSI-2 standard), as follows:

0	The data in the Information field is undefined.
1	The data in the Information field is valid for the command receiving the Check Condition status.

Byte 00, Bits 6 through 0 – Error Code

This field indicates with what command the reported sense data is associated, as follows:

70h	The sense data is associated with the command that received the Check Condition status.
71h	The sense data is for a deferred error condition and is associated with an earlier command.

Byte 02, Bit 7 – FMK (Filemark)

This bit indicates whether the current command detected a filemark or setmark, as follows:

0	No filemarks or setmarks were detected.
1	The current command detected a filemark or setmark.

Byte 02, Bit 6 – EOM (End of Medium)

When set to 1, this bit indicates that one of the following end of medium conditions has been encountered.

- The tape is at or past the early warning (logical end of partition or tape).
- The tape is at LBOP (the tape drive encountered the logical beginning of partition during a backward motion).

Byte 02, Bit 5 – ILI (Illegal Length Indicator)

When set to 1, this bit indicates that the logical block length requested did not match the actual logical block length of the data recorded on the tape.

Byte 02, Bits 3 through 0 – Sense Key

This field contains the sense key associated with the current sense data. Table 5-29 lists the sense key values supported by the tape drive.

Table 5-29 *Sense Key values*

Sense Key	Meaning	Explanation
0h	No Sense	Indicates that there is no specific sense key information to be reported for the designated logical unit. This occurs when a command completes successfully or returns Check Condition or Command Terminated status with the FMK, EOM, or ILI bits set to 1.
1h	Recovered Error	Indicates that the last command completed successfully with some recovery action performed by the tape drive. Details may be available by examining the additional sense bytes and the information field.
2h	Not Ready	Indicates that the tape drive does not contain a data cartridge or that the data cartridge is not loaded. Operator intervention may be required to correct this condition.
3h	Medium Error	Indicates that the command terminated with a non-recoverable error condition that may have been caused by a flaw in the tape or an error in the recorded data. The tape drive may also return this sense key if it is unable to distinguish between a flaw in the tape and a specific hardware failure (sense key 4h).
4h	Hardware Error	Indicates that the tape drive detected a non-recoverable hardware failure (for example a device failure or parity error) while performing the command or during a self-test.
5h	Illegal Request	Indicates that there was an illegal parameter in the CDB or in the additional parameters supplied as data for a command or that the tape drive is in the wrong mode to execute the command. If the tape drive detects an invalid parameter in the CDB, the tape is not written. If the tape drive detects an invalid parameter in the additional parameters supplied as data, the tape may already be altered. This sense key can also indicate an invalid Identify message.
6h	Unit Attention	Indicates one of the following: ▸ The tape drive has been reset (by a power-on reset, a Bus Device Reset message, or a SCSI bus reset). ▸ An initiator changed the MODE SELECT parameters since the last command was issued to the tape drive. ▸ The eject button was pressed and the data cartridge was ejected. ▸ A data cartridge was inserted and automatically loaded. ▸ The internal microcode (firmware) was changed. ▸ A log parameter (counter) reached a specified threshold value (assuming that RLEC bit on the MODE SELECT Control Mode page is set to 1). This sense key is reported the first time any command is issued by each initiator after the condition is detected, and the requested command is not performed. This sense key is cleared when the next command other than INQUIRY or REQUEST SENSE is received by the tape drive.
7h	Data Protect	Indicates that a command that writes to tape was attempted on a write-protected data cartridge. The write operation is not performed.
8h	Blank Check	Indicates that the tape drive encountered blank tape or format-defined EOD (blank tape) during a read, space, or locate operation.

***Table 5-29** Sense Key values (continued)*

Sense Key	Meaning	Explanation
Bh	Aborted Command	Indicates that the tape drive aborted the command. This condition occurs when an Initiator Detected Error (05h) message is received during command execution or when a Message Reject (07h) or SCSI bus parity error is detected by the tape drive during Command or Data Out phase. The initiator may be able to recover by trying the command again.
Dh	Volume Overflow	Indicates that the last WRITE or WRITE FILEMARKS command reached the physical end of tape (PEOT) and that data may remain in the buffer.
Eh	Miscompare	Indicates that the source data did not match the data read from the tape.

Bytes 03 through 06 – Information

The value in this field is command and error condition dependent. In general, it represents the number of blocks or bytes of data that were not processed due to the condition that resulted in a Check Condition status.

- For the READ, READ BUFFER, WRITE, WRITE BUFFER, WRITE FILEMARKS, and VERIFY commands, this field contains the difference between the number of blocks or bytes requested and the number that were actually transferred.
- For the SPACE command, this field contains the difference between the number of filemarks, setmarks, or data blocks requested and the actual number spaced over. By default, when a backward space operation is requested, the difference is a negative number using 2's complement format.

This field is valid only when the Valid bit (byte 00, bit 7) is set to 1. When the Valid bit is set to 0, any data in this field is invalid.

Byte 07 – Additional Sense Length

This byte indicates the length, in bytes, of any additional sense data provided by the tape drive, excluding this byte. The tape drive returns 36 (24h) bytes of additional sense data.

Bytes 08 through 11 – Command-Specific Information

The tape drive does not use this field. The value returned is always 0.

Byte 12 – Additional Sense Code (ASC)

This field contains the Additional Sense Code (ASC) data. The ASC, in conjunction with the Additional Sense Code Qualifier (byte 13), provides additional information about the error indicated by the sense key.

Byte 13 – Additional Sense Code Qualifier (ASCQ)

This field contains the Additional Sense Code Qualifier (ASCQ) data. The ASCQ, in conjunction with the Additional Sense Code (byte 12), provides additional information about the error indicated by the sense key.

Byte 14 – Field Replacable Unit Code

There are no field replaceable parts. The value returned for this field is always 0.

Bytes 15 through 17 – Sense Key Specific Data for Illegal Request (SK 5h)

When the sense key indicates Illegal Request (5h) and the SKSV is 1, the Sense Key Specific Data returns additional information about the Illegal Request, formatted as follows:

Byte \ Bit	7	6	5	4	3	2	1	0
15	SKSV	C/D	Reserved		BPV	Bit Pointer		
16	(MSB)	Field Pointer						(LSB)
17								

Byte 15, Bit 7 – SKSV (Sense Key Specific Valid) This field indicates whether the data in the Sense Key Specific Data field (bytes 15 through 17) is valid, as follows:

0	The Sense Key Specific Data is not valid.
1	The Sense Key Specific Data is valid. The Sense Key Specific Data is valid only when the sense key is Illegal Request (5h).

Byte 15, Bit 6 – C/D (Command/Data) This field indicates the location of the illegal parameter, as follows:

0	The illegal parameter is in the parameters sent by the initiator.
1	The illegal parameter is in the command descriptor block.

Byte 15, Bit 3 – BPV (Bit Pointer Valid) This field indicates whether the bit pointer for the illegal parameter is valid, as follows:

0	The Bit Pointer information is not valid.
1	The Bit Pointer information is valid.

Byte 15, Bits 2 through 0 – Bit Pointer This field indicates which bit of the byte indicated by the Field Pointer is in error. If a multiple bit field is in error, the Bit Pointer indicates the most significant (left-most) bit of the field. Refer to the appropriate command chapter in this reference for the definition of the indicated bit.

Bytes 16 and 17 – Field Pointer This field indicates which byte of the command descriptor block or parameter data was in error. If a multiple-byte field is in error, the Field Pointer indicates the most significant (left-most) byte of the field. Refer to the appropriate command chapter in this reference for the definition of the indicated byte.

Sense Byte Pending Status

When the tape drive reports Check Condition status in response to a command from an initiator, the tape drive retains the sense byte pending status, including error information and Check Condition status, for the initiator until one of the following occurs:

- Error information is reset by the next command other than INQUIRY from the same initiator.
- Error information is reset by a power-on reset, a Bus Device Reset message, or a SCSI bus reset condition.

RESERVE UNIT (16h)

The RESERVE UNIT command reserves the tape drive for an initiator's exclusive use or, if third-party reservations are in effect, for another SCSI device's use. The reservation remains in effect until a RELEASE UNIT command is received from the same initiator or until the tape drive is reset by a SCSI bus reset, a Bus Device Reset message, or a power-on reset.

It is not an error for the initiator that made the last reservation to send another valid RESERVE UNIT command.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	1	0
01	Reserved			3rdPty	Third Party Device ID			RSVD
02	Reserved							
03								
04								
05	Control							

CDB Field Definitions

Byte 01, Bit 4 – 3rdPty (Third Party)

This bit indicates whether a third-party reservation is requested, as follows:

0	Reservation is for current initiator.
1	Reservation is for a third-party as specified in the Third Party Dev ID.

Byte 01, Bits 3 through 1 – Third Party Device ID

This field indicates the SCSI ID of the device for which the initiator is making the third-party reservation. The tape drive ignores this field if the initiator is not requesting a third-party reservation.

Exceptions and Error Conditions

If the tape drive is reserved and it receives any command (other than an INQUIRY (12h), PREVENT/ALLOW MEDIUM REMOVAL (1Eh), or REQUEST SENSE (03h) command) from another initiator, it does not honor the command. Instead, it returns Reservation Conflict (18h) status to the initiator that sent the command.

REWIND (01h)

The REWIND command causes the tape drive to rewind the tape to the logical beginning of tape (LBOT) or, if the tape is partitioned, to the logical beginning of the partition (LBOP) in which the tape is currently positioned.

Notes:

- If the disconnect option is enabled, the tape drive disconnects from the initiator while the REWIND command is executing.
- If the tape is already at LBOT (or LBOP for a partitioned tape) and there is no data in the buffer, no tape motion results.
- If the tape drive receives a command while the tape is rewinding, its response is determined by the value in the RespDuringImmed field on the MODE SELECT Vendor Unique Parameters Page 1 page (see page 199**).**
- If the REWIND command follows a WRITE (0Ah) or WRITE FILEMARKS (10h) command, the tape drive writes all buffered data, filemarks, or setmarks and appends an end of data (EOD) mark before the tape is rewound.

- If an error occurs during the writing of the data in the buffer to the tape, the tape drive returns Check Condition status. The rewind operation is not performed. The initiator should issue a REQUEST SENSE (03h) command to determine the cause of the error.
- If there is data in the buffer because an earlier WRITE (0Ah) command was terminated with Check Condition status, the tape drive discards that data before rewinding the tape.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	0	1
01	Reserved							Immed
02	Reserved							
03								
04								
05	Control							

CDB Field Definitions

Byte 01, Bit 0 – Immed

The value in this field determines when command status is returned to the initiator, as follows:

0	Status is reported when the REWIND command is completed.
1	Status is reported when the REWIND command is initiated by the tape drive.

If the tape drive's buffer contains data from a previous WRITE command, the tape drive disconnects from the initiator (if disconnect is enabled) and writes the data in the buffer to the tape.

- **If the Immed bit is set to 1**, the tape drive reconnects to the initiator when the write operation has completed successfully. It then returns Good status and performs the rewind operation.

  Note: Completing the write operation includes emptying the buffer to tape and writing the EOD mark.

- **If the Immed bit is set to 0**, the tape drive reconnects and returns status when the rewind operation is complete.

Exceptions and Error Conditions

Table 5-2 lists exceptions and error conditions that cause the tape drive to return Check Condition status for the REWIND command.

Table 5-30 *REQUEST SENSE data for REWIND command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Explanation
02h	04h	01h	**Not Ready.** Tape drive is not ready, it is in process of initializing itself.
02h	04h	03h	**Not Ready.** The tape drive is not ready because it needs manual intervention.
02h	3Ah	00h	**Not Ready.** Tape drive is not ready. Command requires a tape, and no tape is present.
03h	30h	02h	**Medium Error.** The tape format is incompatible with the tape drive hardware or microcode.
03h	31h	01h	**Medium Error.** The tape format is corrupted.
04h	15h	01h	**Hardware Error.** The tape drive cannot position the tape correctly.
06h	30h	00h	**Unit Attention.** Incompatible media was rejected after the cartridge was inserted.

SPACE (11h)

The SPACE command enables the tape drive to perform forward or backward searches. You can use this command to space directly to the end of data (EOD) or to space over a specified number of logical blocks, filemarks, or setmarks.

Notes:

- The tape drive can space over both fixed- and variable-length logical blocks; it determines the type of spacing to use according to the type of block found on the tape.
- If the disconnect option is enabled, the tape drive can disconnect from the initiator while the SPACE command is executing.
- If you attempt to space backward immediately after writing data, filemarks, or setmarks, the tape drive will complete the write operation before performing the space operation. Completing the write operation includes writing any buffered data to tape and writing an end of data (EOD) mark.

  If an error occurs when the data in the buffer is being written, the tape drive returns Check Condition status and the space operation is not performed. You can issue a REQUEST SENSE (03h) command to determine the cause of the error.

On a partitioned tape, spacing is limited to locations within the current partition. If you want to space to a location outside of the current partition, you must move to the new partition using the LOCATE or MODE SELECT command.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	1	0	0	0	1
01	Reserved					Code		
02	(MSB)	Count						(LSB)
03								
04								
05	Control							

CDB Field Definitions

Byte 01, Bits 2 through 0 – Code

The Code field specifies the type of space operation the tape drive is to perform. Table 5-31 lists the valid values for the Code field and indicates the type of operation each specifies. See page 259 for information about the errors and exceptions that can occur for each of these values.

Table 5-31 *Valid values for the Code field in the SPACE (11h) CDB*

Value of Code field	Type of operation	Notes
000b	Space over *n* fixed or variable-length blocks	Space over the next *n* blocks. If the tape drive encounters a filemark, or if it encounters a setmark and the RSmk bit in MODE SELECT is set to 1, the tape drive terminates the command.
001b	Space over *n* filemarks	Space over the next *n* filemarks. If the tape drive encounters a setmark and the RSmk bit on the MODE SELECT Device Configuration page (Page Code=10h) is set to 1, the tape drive terminates the command.
011b	Space to end of data	When you set the Code field to 011b, the tape drive ignores the setting of the Count field. Instead, it spaces forward until it encounters EOD. The tape is positioned so that a subsequent WRITE command can append data after the last block, filemark, or setmark written before the end of data.
100b	Space over *n* setmarks	When you set the Code field to 100b, the tape drive ignores the setting of the RSmk bit on the MODE SELECT Device Configuration page (Page Code=10h). In addition, the tape drive ignores filemarks.

Table 5-31 *Valid values for the Code field in the SPACE (11h) CDB (continued)*

Value of Code field	Type of operation	Notes
010b	Reserved	If you set the Code field to one of these values, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h).
101b		
110b		
111b		

Bytes 02 through 04 – Count

The count value, *n*, in this field represents the number of blocks, filemarks, or setmarks to be spaced over. The value of *n* determines the direction of spacing, as follows:

- A positive value of *n* in the Count field causes the tape drive to space forward *n* blocks, filemarks, or setmarks. When the space operation is complete, the tape is logically positioned on the EOD side of the *n*th block, filemark, or setmark.
- A negative value of *n* (in 2's complement notation) in the Count field causes the tape drive to space backward over *n* blocks, filemarks, or setmarks. When the operation is complete, the tape is logically positioned on the BOP side of the *n*th block, filemark, or setmark.
- A value of 0 in the Count field causes no change in the tape position and is not an error.

Note: The tape drive ignores the Count field when spacing to end of data.

Exceptions and Error Conditions

The following exceptions and error conditions can occur with the SPACE command.

Filemark Detected

If the Code field has a value of 000b (space over *n* logical blocks) and a filemark is detected, the tape drive terminates the command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
Filemark	1
Sense Key	0h (No Sense)
Information bytes	Indicate the difference between the requested number of blocks and the actual number of blocks spaced over. This value is always positive.
ASC	00h
ASCQ	01h (Filemark Detected)
FSC	28h

If the filemark was detected during a forward search, the tape is logically positioned on the EOD side of the filemark. If the filemark was detected during a backward search, the tape is logically positioned on the BOP side of the filemark.

Note: Filemarks are ignored if you previously set the Code field to space over setmarks (100b).

Early Warning Encountered

If an early warning is encountered after the completion of a space operation (regardless of the value of the Code field) and the REW bit on the MODE SELECT Device Configuration page (Page Code 10h) is set to 1, the tape drive terminates the command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	0 or 1
EOM	1
Sense Key	3h (Medium Error)
Information bytes	The Information bytes are invalid.
ASC	00h
ASCQ	02h (End of Tape or End of Partition Detected)
FSC	2Ah, 2Dh

If the early warning was detected during a forward search, the tape is logically positioned on the EOD side of the target filemark, setmark, or logical block. If the early warning was detected during a backward search, the tape is logically positioned on the BOP side of the target filemark, setmark, or logical block.

Setmark Detected

If the Code field has a value of 000b (space over *n* logical blocks) or 001b (space over *n* filemarks) and a setmark is detected, the tape drive looks at the setting of the RSmk bit on the MODE SELECT Device Configuration page (Page Code 10h):

- If the bit is 0 (do not report setmarks), the tape drive continues to space over blocks or filemarks.
- If the bit is 1 (report setmarks), the tape drive terminates the command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
Filemark	1
Sense Key	0h (No Sense)
Information bytes	Indicate the difference between the requested number of blocks or filemarks and the actual number of blocks or filemarks spaced over. This value is always positive.
ASC	00h
ASCQ	03h (Setmark Detected)
FSC	40h

If the setmark was detected during a forward search, the tape is logically positioned on the EOD side of the setmark. If the setmark was detected during a backward search, the tape is logically positioned on the BOP side of the setmark.

PBOT or PBOP Encountered

If the Code field has a value of 000b, 001b, or 100b (space over logical blocks, filemarks, or setmarks) and the physical beginning of tape (PBOT) or physical beginning of partition (PBOP) is encountered while spacing backward, the tape drive terminates the command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
EOM	1
Sense Key	0h (No Sense)
Information bytes	Indicate the difference between the requested number of blocks, filemarks, or setmarks and the actual number spaced over. This value is always positive.
ASC	00h
ASCQ	04h (Beginning of Tape or Beginning of Partition Detected)
FSC	29h, 2Bh

After PBOT (or PBOP) is encountered, the tape is positioned at LBOT (or LBOP).

EOD Detected

If the Code field has a value of 000b (space over *n* logical blocks), 001b (space over *n* filemarks), or 100b (space over *n* setmarks), and the EOD mark is detected, the tape drive returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
EOM	0 or 1. Set to 1 if early warning has been detected.
Sense Key	Blank Check (8h)
Information bytes	Indicate the difference between the requested number of blocks, filemarks, or setmarks and the actual number spaced over. This value is always positive.
ASC	00h
ASCQ	05h (EOD Detected)
FSC	2Ch

The tape is positioned so that a subsequent WRITE command can append data after the last information written before EOD.

Unrecoverable Error

If an unrecoverable media or hardware error occurs during the space operation, the tape drive terminates the SPACE command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	0 or 1
Sense Key	Medium Error (3h) or Hardware Error (4h)
Information bytes	If Valid=1, indicate the difference between the requested number of blocks, filemarks, or setmarks and the actual number spaced over. The actual length does not include the unrecovered block. This value is always positive.
Other bits and bytes	Depend on the error condition

When the SPACE command is terminated, the position of the tape drive depends on whether a forward or backward space was attempted:

- If the error occurred during a forward space, the tape drive is positioned after the unrecovered block.
- If the error occurred during a backward space, the tape drive is positioned before the unrecovered block.

Table 5-32 lists additional exceptions and error conditions that cause the tape drive to return Check Condition status for the SPACE command.

Table 5-32 *REQUEST SENSE data for SPACE command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
02h	04h	01h	**Not Ready.** In the process of becoming ready. The tape drive is in the process of initializing itself.
02h	04h	03h	**Not Ready.** The tape drive requires manual intervention.
02h	3Ah	00h	**Not Ready.** The command requires a tape and no tape is present.
03h	00h	02h	**Medium Error.** The tape drive encountered the physical end of tape (PEOT) or the physical end of partition (PEOP) before completing the operation.
03h	14h	00h	**Medium Error.** The tape drive cannot perform the locate operation because it cannot read data from the tape.
03h	14h	03h	**Medium Error.** The tape drive cannot locate the end of data (EOD) on the tape.
0h	31h	00h	**Medium Error.** The format of the currently loaded tape is corrupted.

***Table 5-32** REQUEST SENSE data for SPACE command errors and exceptions (continued)*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
4h	15h	01h	**Hardware Error.** The tape drive cannot properly position the media.
6h	30h	00h	**Unit Attention.** The currently loaded tape is incompatible with the tape drive.

TEST UNIT READY (00h)

The TEST UNIT READY command provides a means for determining if the tape drive is ready to accept an appropriate medium access command.

The TEST UNIT READY command returns Good status after the tape is loaded if the tape drive is ready to accept a medium access command without returning Check Condition status. If the tape drive is not ready to accept a medium access command, the tape drive returns Check Condition status with the sense key set to Not Ready (2h).

Note: The TEST UNIT READY command is not a request for a unit self-test.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	0	0
01	Reserved							
02								
03								
04								
05	Control							

CDB Field Definitions

Reserved – Bytes 01 through 05

All fields in this CDB are reserved. The value for these fields must be 0.

Exceptions and Error Conditions

Table 5-33 lists exceptions and error conditions that cause the tape drive to return Check Condition status for the TEST UNIT READY command.

Table 5-33 *REQUEST SENSE data for TEST UNIT READY command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
02h	04h	01h	**Not Ready.** The tape drive is in the process of initializing itself.
02h	04h	03h	**Not Ready.** The tape drive requires manual intervention.
02h	3Ah	00h	**Not Ready.** The command requires a tape and no tape is present.
05h	25h	00h	**Illegal Request.** The logical unit specified in the CDB is not supported.

WRITE (0Ah)

The WRITE command transfers one or more bytes or blocks of data from the initiator to the media loaded in the tape drive.

After writing data, the tape drive writes an end of data (EOD) mark to indicate the location of the last data on tape. The EOD mark is overwritten when additional data is appended to the last data on the tape.

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	0	1	0	1	0
01	Reserved							Fixed
02	(MSB)	Transfer Length						(LSB)
03								
04								
05	Control							

Tape Positioning

This section describes the legal tape positions for a write operation.

Tape Positioned at LBOT or LBOP

When writing to a tape positioned at LBOT or LBOP, the tape drive automatically writes a new LBOT (or LBOP) pattern and then writes the data from the buffer.

Appending Data

When writing to tape, the tape drive can append new data to existing data at certain locations only. If the tape is not positioned at a legal location, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h). The legal locations for appending data are:

- EOD mark (the EOD mark is overwritten as new data is appended)
- Beginning or end of a filemark
- Beginning or end of a setmark

Note: If data is appended at the beginning of a filemark or setmark, the filemark or setmark is overwritten.

Data Buffering

The tape drive provides two modes of operation for the WRITE command: unbuffered and buffered. The mode of operation is set with the MODE SELECT command (byte 02, bits 6 through 4, in the Parameter List Header).

Unbuffered Write Operation

When the tape drive is set for an unbuffered write operation, it returns Good status as soon as all data blocks are written to tape.

Buffered Write Operation

When the tape drive is set for a buffered write operation, it returns Good status as soon as all data blocks are successfully transferred to the buffer. The data in the buffer is written to tape when one of the following conditions occurs:

- The Buffer Full Threshold is reached during a WRITE command.
- The tape drive receives one of the following commands:
  - ERASE
  - LOCATE
  - LOAD/UNLOAD
  - READ
  - READ BUFFER
  - REWIND
  - SPACE
  - WRITE BUFFER
  - WRITE FILEMARKS (with the Immed bit set to 0)
- The operator presses the eject button.
- The time specified for the Write Delay Time field in the Device Configuration Page elapses (note, however, if the Write Delay Time field is 0, a partially full buffer is not flushed to tape). See page 210 for more information about the Write Delay Time field.

CDB Field Definitions

Byte 01, Bit 0 – Fixed

This field specifies the type of write operation the tape drive is to perform, as follows:

0	Write a single variable-length logical block. The length of this block is specified in the Transfer Length field.
1	Write one or more fixed-length logical blocks. The number of blocks is specified in the Transfer Length field.

Bytes 02 through 04 – Transfer Length

This field specifies the amount of data the tape drive is to write, as follows:

- When the Fixed bit is set to 0 (write variable-length blocks), this field contains the length of the logical block in bytes. The logical block can be any size from 1 byte to 245,760 bytes (240 KB). The valid value for this field is from 000001h to 03C000h (245,760 bytes).
- When the Fixed bit is set to 1 (write fixed-length blocks), this field contains the number of logical blocks to be written. The length of each block is either the power-on default block length or the length specified with the currently active MODE SELECT command (see page 202). Only block sizes that are evenly divisible by four (that is, they end on a 4-byte boundary) are valid.

Note: When the value for the Transfer Length field is 0, no data is transferred and the current position of the tape is not changed.

Exceptions and Error Conditions

The following exceptions and error conditions can occur with the WRITE command.

Unrecoverable Error

If an unrecoverable write error occurs before the write operation completes, the tape drive terminates the WRITE command and returns Check Condition status. Data that remains in the buffer is not written to tape. The REQUEST SENSE data is set as follows:

Valid	0 or 1
Sense Key	3h (Medium Error)
Information bytes	If Valid=1, depend on the setting of the Fixed bit, as follows: ▸ If the Fixed bit is 0, equal the requested transfer length. ▸ If the Fixed bit is 1, equal the difference between the requested transfer length and the actual number of logical blocks written.
ASC	00h
ASCQ	00h (Write Error)

Note: If another WRITE command is issued after an unrecoverable error occurs, the tape drive returns Check Condition status with the sense key set to Medium Error or Hardware Error and the command is not executed.

Early Warning Encountered

If early-warning is encountered during the WRITE command, or a WRITE command is issued with the logical position between early-warning and EOP, the drive attempts to finish writing all data. If all data can be written, the tape drive returns Check Condition status after the command completes.

Valid	1
EOM	1
Sense Key	0h (No Sense)
Information bytes	000000h (no data was left unwritten)
ASC	00h
ASCQ	02h (End of Tape or End of Partition Detected)
FSC	2Ah, 2Dh

PEOT or PEOP Encountered

If the physical end of tape (PEOT) or physical end of partition (PEOP) is encountered, the tape drive terminates the WRITE command and returns Check Condition status. Data that remains in the buffer is not written to tape. The REQUEST SENSE data is set as follows:

Valid	0 or 1
EOM	1
Sense Key	Dh (Volume Overflow)
Information Bytes	If Valid=1, depend on the setting of the Fixed bit, as follows: ▸ If the Fixed bit is 0, the Information bytes equal the requested transfer length. ▸ If the Fixed bit is 1, the Information bytes equal the difference between the requested transfer length and the actual number of logical blocks written.
ASC	00h
ASCQ	02h (End of Tape or End of Partition Detected)
FSC	2Ah, 2Dh

Table 5-34 lists additional exceptions and error conditions that cause the tape drive to return Check Condition status for the WRITE command.

Table 5-34 *REQUEST SENSE data for WRITE command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
2h	04h	01h	**Not Ready.** The tape drive is in the process of initializing itself.
2h	04h	03h	**Not Ready.** The tape drive requires manual intervention.
2h	3Ah	00h	**Not Ready.** The command requires a tape and no tape is present.
3h	30h	02h	**Medium Error.** The format of the currently loaded tape is not compatible with the tape drive or the tape drive firmware.
0h	31h	00h	**Medium Error.** The format of the currently loaded tape is corrupted.
0h	50h	00h	**Medium Error.** Write failure after retry limit (specified in MODE SELECT) was exceeded.
4h	15h	01h	**Hardware Error.** The tape drive cannot properly position the media.

Table 5-34 *REQUEST SENSE data for WRITE command errors and exceptions (continued)*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
5h	24h	00h	**Illegal Request.** Invalid field in CDB. This error is a result of any of the following: ▸ The Fixed bit is set to 0 and the Transfer Length is not within the range specified by the READ BLOCK LIMITS command. ▸ The Fixed bit is set to 1 and the Block Length specified in the MODE SELECT command is set to 0. ▸ The Transfer Length exceeds 03C000h (245,760 bytes) for a variable-length write operation.
5h	50h	01h	**Illegal Request.** A WRITE command was issued at an invalid tape position.
6h	30h	00h	**Unit Attention.** The currently loaded tape is incompatible with the tape drive.
7h	27h	00h	**Write Protect.** A write operation was attempted on a data cartridge that is write protected.
Bh	47h	00h	**Aborted Command.** A SCSI parity error occurred during data transfer.

WRITE BUFFER (3Bh)

The WRITE BUFFER command is accepted by the tape target but performs no useful action.

WRITE FILEMARKS (10h)

The WRITE FILEMARKS command causes the tape drive to write any data remaining in the buffer from a previous WRITE command to tape and then to write zero or more filemarks or setmarks to tape.

A write filemarks operation can be performed at the following logical tape positions:

- **Tape Positioned at LBOT or LBOP.** When writing to a tape positioned at the logical beginning of tape (LBOT) or at the logical beginning of partition (LBOP), the tape drive automatically writes a new LBOT pattern and then writes the requested number of filemarks (or setmarks).
- **Appending Data.** The tape drive can append filemarks (or setmarks) to existing data as long as the tape is positioned at one of the following locations:
  - End of data (EOD) mark
  - Beginning or end of a long filemark
  - Beginning or end of a setmark

If the tape is not positioned at one of these locations, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h).

Byte \ Bit	7	6	5	4	3	2	1	0
00	0	0	0	1	0	0	0	0
01	Reserved						WSmk	Immed
02	(MSB)	Transfer Length						
03								
04								(LSB)
05	Short	Control						

CDB Field Definitions

Byte 01, Bit 1 – WSmk (Write Setmark)

This field specifies whether you want the tape drive to write setmarks or filemarks at the current position, as follows:

0	Write filemarks at the current position
1	Write setmarks at the current position

Byte 01, Bit 0 – Immed

The value for this field determines when command status is returned to the initiator, as follows:

0	Status is reported to the initiator when the WRITE FILEMARKS command is completed. All buffered data, filemarks, and setmarks are written to the tape before the command is completed.
1	Status is reported to the initiator when the WRITE FILEMARKS command CDB is validated by the tape drive. This mode is valid only if the tape drive is operating in buffered mode (see page 219).

Bytes 02 through 04 – Transfer Length

This field specifies the number of filemarks (or setmarks) to be written to tape. Valid values for this field are from 0000h to 00FFh (0 to 255). A value of 0 results in either of the following:

- If the Immed bit is 0, no filemarks (or setmarks) are transferred and the data in the buffer is written to the tape.
- If the Immed bit is 1, no operation is performed, the logical position of the tape remains unchanged, and the tape drive returns Good status.

Byte 05, Bit 7 – Short

The value for this field determines the size of the filemark written to tape, as follows:

0	Write a long filemark
1	Write a short filemark

The tape drive ignores this field because there is no distinction between short and long file marks. This field is supported for compatibility purposes only.

Exceptions and Error Conditions

The following exceptions and error conditions can occur with the WRITE FILEMARKS command.

Early Warning Encountered

If early-warning is encountered during the WRITE FILEMARKS command, or a WRITE FILEMARKS command is issued with the logical position between early-warning and EOP, the drive attempts to finish writing all data. If all data can be written, the tape drive returns Check Condition status after the command completes.

Valid	1
EOM	1
Sense Key	0h (No Sense)
Information bytes	000000h (no data was left unwritten)
ASC	00h
ASCQ	02h (End of Tape Detected)
FSC	2Ah

PEOT or PEOP Encountered

If the physical end of tape (PEOT) or physical end of partition (PEOP) is encountered, the tape drive terminates the WRITE FILEMARKS command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	0 or 1
EOM	1
Information bytes	If Valid=1, contain the difference between the requested number of filemarks (or setmarks) and the actual number of filemarks (or setmarks) written.
Sense Key	Dh (Volume Overflow)
ASC	00h
ASCQ	02h (End of Tape or End of Partition Detected)
FSC	2Dh

Unrecoverable Error

If an unrecoverable write error occurs before the write filemarks operation completes, the tape drive terminates the WRITE FILEMARKS command and returns Check Condition status. Data that remains in the buffer is not written to tape. The REQUEST SENSE data is set as follows:

Valid	0 or 1
Sense Key	3h (Medium Error)
Information bytes	If Valid=1, contain the difference between the requested transfer length and the actual number of filemarks (or setmarks) written.
ASC	0Ch
ASCQ	00h (Write Error)

Note: If another WRITE FILEMARKS command is issued after an unrecoverable error occurs, the tape drive returns Check Condition status with the sense key set to Medium Error or Hardware Error and the command is not executed.

Table 5-35 lists additional exceptions and error conditions that cause the tape drive to return Check Condition status for the WRITE FILEMARKS command.

Table 5-35 *REQUEST SENSE data for WRITE FILEMARKS command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
02h	04h	01h	**Not Ready.** The tape drive is in the process of initializing itself.
02h	04h	03h	**Not Ready.** The tape drive requires manual intervention.
02h	3Ah	00h	**Not Ready.** The command requires a tape and no tape is present.
03h	30h	02h	**Medium Error.** The format of the currently loaded tape is not compatible with the tape drive or the tape drive firmware.
0h	31h	00h	**Medium Error.** The format of the currently loaded tape is corrupted.
0h	50h	00h	**Medium Error.** Write append error. Write failure after retry limit (specified in MODE SELECT) was exceeded.
4h	15h	01h	**Hardware Error.** The tape drive cannot properly position the media.
5h	24h	00h	**Illegal Request.** Invalid field in CDB. The Transfer Length exceeds 00FFh (255) filemarks (or setmarks).
5h	50h	01h	**Illegal Request.** A WRITE command was issued at an invalid tape position.
6h	30h	00h	**Unit Attention.** The currently loaded tape is incompatible with the tape drive.
7h	27h	00h	**Data Protect.** A write operation was attempted on a data cartridge that is write protected.

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